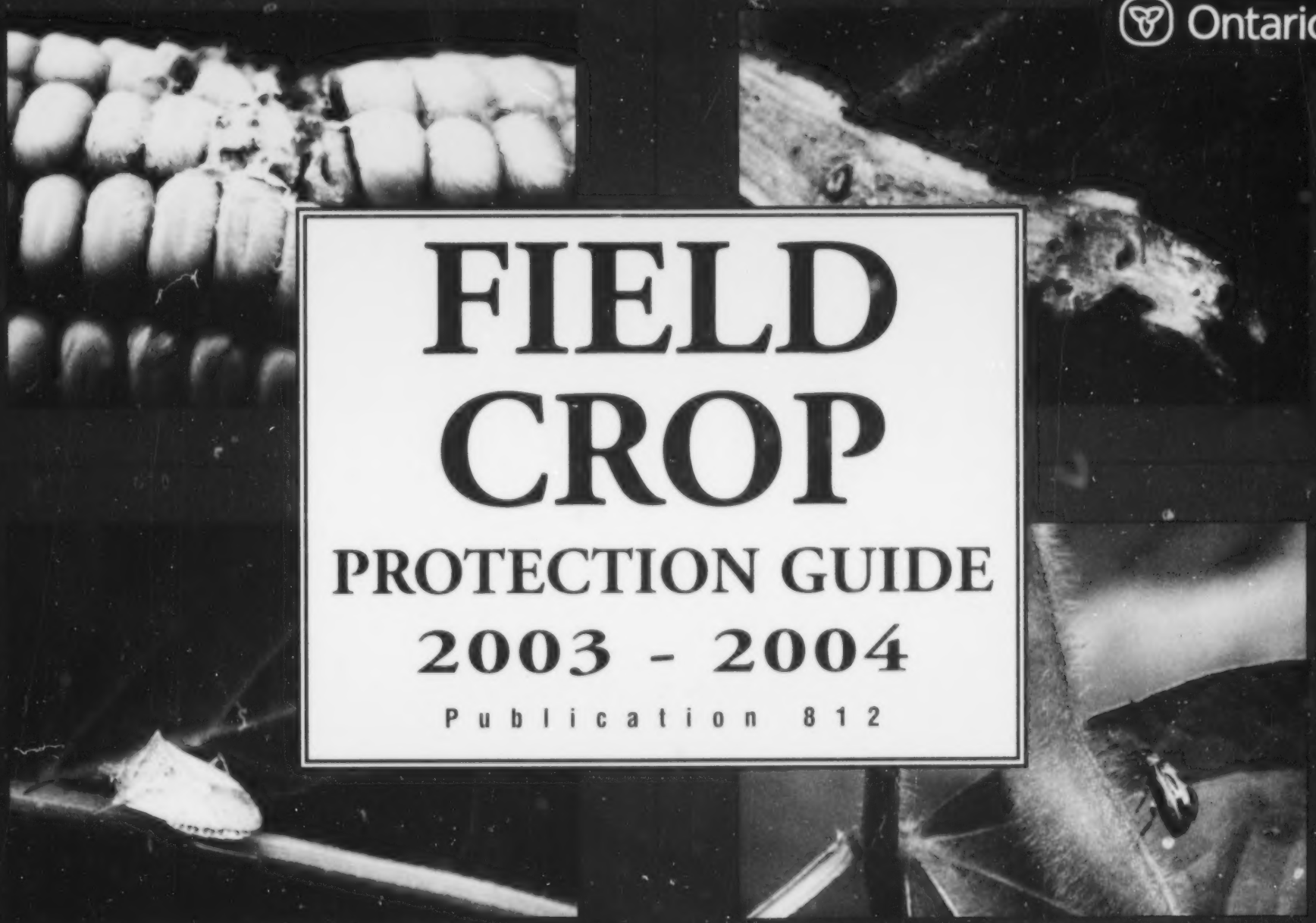


Ontario

FIELD CROP PROTECTION GUIDE 2003 - 2004

Publication 812

MINISTRY OF AGRICULTURE AND FOOD

Recycle old editions of this publication. Each year the appropriate working group of the Ontario Pest Management Research and Services Committee reviews the pesticides listed in this publication. To the best knowledge of the committee, at the time of printing, all of these pesticides were:

- federally registered
- reviewed by the Ontario Pesticides Advisory Committee (OPAC)
- classified by the Ministry of the Environment as of November 2002.

The information in this publication is general information only. By printing this publication, the Ministry of Agriculture and Food does not offer any warranty or guarantee, nor does it assume any liability for any crop loss, animal loss, health, safety or environmental hazard caused by the use of a pesticide mentioned in this publication.

The pesticide product label is a legal document.
It is against the law to use the product in any other way.
You must also use all pesticides in accordance with the *Pesticides Act* and Regulation 914, administered by the Ontario Ministry of the Environment.

In this publication, most recommendations list several pesticides that can be used for each pest discussed. In general the least hazardous materials and those pesticides that pesticide applicators have used satisfactorily for years are listed first. More toxic pesticides and/or newer ones with less practical grower experience follow.

This publication lists a number of brand names of pesticides. This is for your convenience only. It is neither an endorsement of the product nor a suggestion that similar products are ineffective.

Consult each product label for specific information such as compatibility with other materials and the effect of environmental conditions. Weather and other factors influence the effectiveness of pesticides and the likelihood of crop injury.

Health Canada has established maximum residue limits (MRLs) for pesticides. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market as to which restrictions or limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

Federal Registration of Pesticide Products

The Pest Management Regulatory Agency (PMRA) of Health Canada grants registration following an evaluation of scientific data to ensure that the product has merit and value; and the human health and environmental risks associated with its proposed use are acceptable.

1. **Full Registration**
   Pesticide registrations are normally granted for a period of five years, subject to renewal.
2. **Temporary Registration**
   Temporary registration may be granted for a period not to exceed one year, where the registrant agrees to produce additional scientific or technical information, or the pesticide is used for emergency control of a serious pest outbreak.

Supplemental Labels

You MUST obtain a supplemental label and follow all the label directions when PMRA approves new uses for a registered pesticide that do not appear on the current label.

Examples of when you must use a supplemental label include:

- **Temporary Registrations for Emergency Use**
- **Minor Use Label Expansion** (new label statements for crops that do not already appear on that product label).

You can obtain a copy of a supplemental label from the pesticide manufacturer or pesticide vendor, the grower association that sponsored the emergency registration or minor use, from OMAF or PMRA's Pest Management Information Service.

For more information on the federal registration status check the PMRA Web site at *www.hc-sc.gc.ca/pmra-arla* or call **1-800-267-6315.**

Regulation of Pesticides in Ontario

Classification of Pesticides into "Schedules"

The Ministry of the Environment classifies all pesticide products into one of six schedules, based on the potential hazards that product may have for human health and the environment. For up-to-date information on the regulatory status of any pesticide check the Ontario Pesticides Advisory Committee Web site at *www.opac.gov.on.ca* or call (416) 314-9230/ fax (416) 314-9237.

Licensing and Certification Requirements for Pesticide Users

You must be a certified grower or
licensed exterminator to buy and use Schedule 1, 2 and 5 pesticides.

Requirements for Growers and their Assistants

Growers must be certified through the **Grower Pesticide Safety Course** to buy and use Schedules 1, 2 or 5 pesticides on land they farm. There must be at least one certified grower for each farm operation.

All agricultural assistants must also receive formal pesticide safety training, recognized by the Ministry of the Environment, before they can use Schedule 2 or 5 pesticides under the supervision of a certified grower. This applies to all assistants — including family members, farm employees and seasonal workers.

For more information about training for growers and agricultural assistants check the Ontario Pesticide Education Program Web site at *www.ridgetownc.uoguelph.ca/opep/* or call 1-800-652-8573.

Requirements for Commercial Applicators and their Assistants

If you plan to apply pesticides as a business, you must be a licensed exterminator. **This includes farmers who custom apply pesticides for other farmers and charge a fee for this service.** You must complete a home study course and certification exam, and send proof of certification to the Ministry of Environment to obtain your license.

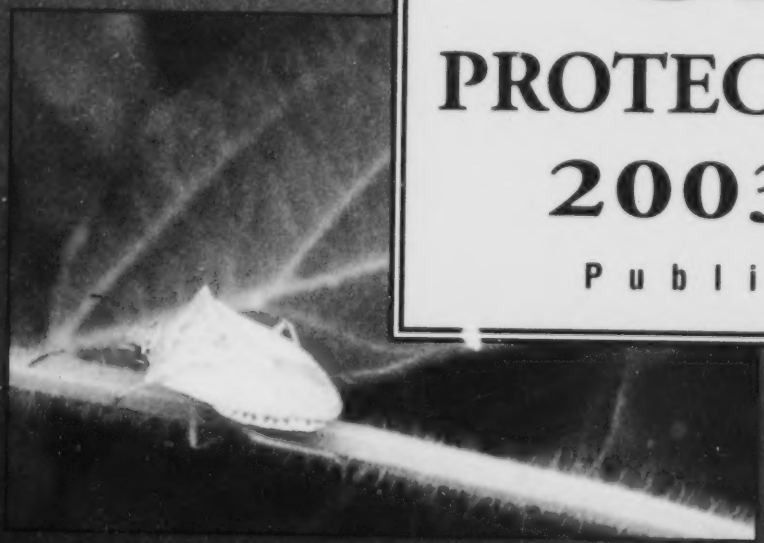
Unlicensed assistants must be Technicians before they may handle Schedule 2 (with restrictions), 3, 4 and 6 products under indirect supervision of a licensed exterminator. Technicians may not handle Schedule 1 and 5 products. For more information about exterminators and technicians check the Ontario Pesticide Training and Certification Web site at *www.ridgetownc.uoguelph.ca/optc* or call 1-888-620-9999.

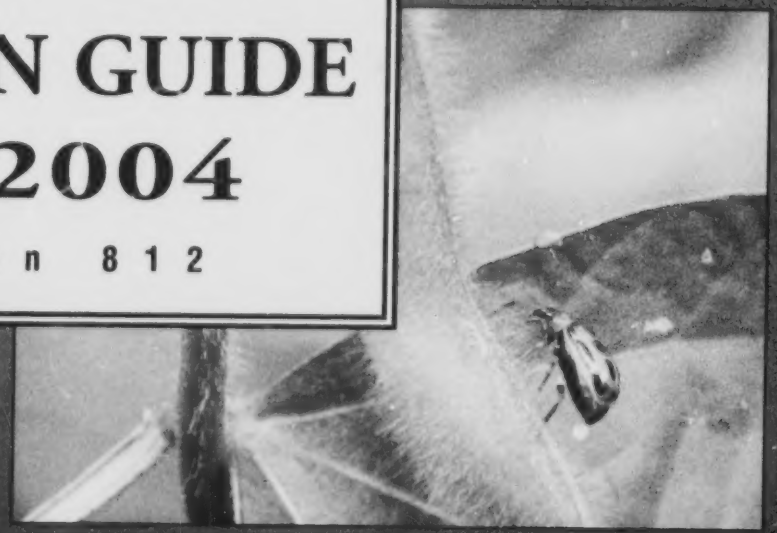
Cette publication est aussi disponible en français.

Ontario

FIELD CROP PROTECTION GUIDE 2003 - 2004

Publication 812





MINISTRY OF AGRICULTURE AND FOOD

This publication contains all pesticide products and IPM management strategies recommended by OMAF for the control of major field crop pests of Ontario. For information related to production, harvest, storage and pest lifecycles, identifcation and other management strategies, refer to the *Agronomy Guide for Field Crops*, Publication 811.

Acknowledgments

The recommendations contained in this publication have been supplied under the direction of the Field Crop Technical Working Group, a subcommittee of the Ontario Field Crop Research and Services Committee, and the Ontario Pest Management Research and Services Committee, and personnel of Crop Technology, OMAF, Ridgetown College/University of Guelph, and Agriculture and Agri-Food Canada.

Need technical and business information?

Contact the Agricultural Information Contact Centre at
1-877-424-1300
or ag.info@omaf.gov.on.ca

Looking for field crop production information on the Internet?

www.gov.on.ca/omaf/english/crops/index.html

It's one-stop shopping for factsheets, articles and photos regarding the production and maintenace of field crops.

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1. Precautions with Pesticides

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Pesticide Regulations

You must report all major spills, fires or thefts involving pesticides to the Ontario Ministry of the Environment at 1-800-268-6060. (*Regulation 914*, s. 29)

Pesticide Schedules in Ontario

The Ontario Ministry of the Environment reviews each pesticide product offered for sale in Ontario and classifies it into 1 of 6 groupings called Schedules.

Certification and Training Requirements

You must be a certified grower or a licensed applicator (exterminator) to buy and use Schedule 1, 2 or 5 pesticides.

Pesticide Certification for Ontario Farmers

Regulation 914 of the *Pesticides Act* requires that agriculturalists (growers) be certified to buy and use Schedules 1, 2 or 5 pesticides on land they farm. To become certified, agriculturalists must:

- attend the Grower Pesticide Safety Course (GPSC) and successfully complete the examination, **and**
- meet the definition of an "agriculturalist" as defined by Regulation 914 under the *Pesticides Act*, (i.e. use farm land for agricultural or forestry production, and that land falls within the farmlands property class under Section 7 of the *Ontario Assessment Act*), and
- be at least 16 years of age.

Training for Agricultural Assistants Using Schedule 2 or 5 Pesticides

All assistants must have formal pesticide safety training that is recognized by the Ministry of the Environment, before they can handle or use Schedule 2 or 5 pesticides under the supervision of a certified grower.

- This applies to all assistants, including family members, farm employees and seasonal workers.
- Trained assistants do not have to write an exam.
- Trained assistants must be 16 years of age or older.
- There are 2 training options for assistants. Assistants can:
  - attend a grower pesticide safety course and not write the certification examination, an examination is not required, or
  - attend an on-farm training session presented by a qualified trained assistant instructor.

Sch.	Who Can Use It	Pesticide Characteristics*
1	• licensed applicator • certified grower • only with approved permit	• **very toxic** and/or • very persistent and/or • highly mobile
2	• licensed applicator • certified grower • trainee or technician under supervision (some restrictions apply) • assistant agriculturist under supervision	• **toxic** and/or • persistent and/or • moderately mobile
3	Any person	• **moderately toxic** and/or • moderately persistent and/or • slightly mobile
4	Any person	• **low toxicity** • non-persistent • non-mobile • containers <1 kg <1 L
5	• licensed applicator • certified grower • assistant agriculturist under supervision	• **very toxic** and/or • very persistent and/or • highly mobile • less toxic or less persistent alternative not available
6	Any person	• **low toxicity** • non-persistent • non-mobile • containers >1 kg > l L

* Biological persistence and mobility in the environment, as expected under normal use conditions in Ontario.

For more information and a list of session dates and locations of grower pesticide safety courses, check the Ontario Pesticide Education Program Web site at www.ridgetownc.uoguelph.ca/opep/.

To register for a grower pesticide safety course anywhere in Ontario, or for information about trained assistants please:

- call: 1-800-652-8573
- fax: 1-519-674-1589
- e-mail: opep@ridgetownc.uoguelph.ca.

Certification and Licensing for Commercial Pesticide Exterminators

For updates to training requirements under Regulation 914 of the *Pesticides Act*, refer to the Ministry of the Environment Web site at www.ene.gov.on.ca/ or phone 1-888-565-4923.

You must be a licensed exterminator if you plan to apply pesticides as a business. This includes farmers who custom-apply pesticides for other farmers and charge a fee for this service. Licensed exterminators who are self-employed must hold an operator license as well as the appropriate exterminator license. Exterminator licenses are valid for 5 years.

To become a licensed exterminator, you must:

- successfully complete a home study course and certification exam through Ridgetown College, University of Guelph, and
- apply to the Ministry of the Environment to obtain your exterminator licence. You will need to send proof of certification (letter of successful completion of the exam(s)) and a fee. (See Appendix D, *Ontario Ministry of the Environment Pesticide Control Offices*, on page 69.)

Training for Technicians Working as Assistants to Licensed Exterminators

Assistants to licensed exterminators must become technicians to mix, load or apply all Schedule 3, 4 and 6 pesticides and most Schedule 2 pesticides (some restrictions apply), under the indirect supervision of a licensed exterminator. Technicians cannot mix, load or apply Schedule 1 or 5 pesticides. Technician cards are valid for 2 years. To become a technician, you must:

- complete an MOE-approved academic course and exam, **and**
- complete practical training with a licensed exterminator.

For more information about certification and licensing requirements for licensed exterminators and training for technicians, contact Ontario Pesticide Training & Certification:

- call: 1-888-620-9999
- fax: 519-674-1585
- Web site: www.ridgetownc.uoguelph.ca/optc.

General Precautions

Always read the label:

- Before you buy a pesticide!
- Before you begin to use a pesticide!
- Before you store a pesticide or dispose of it!

Learn about the health hazards and toxic properties of the pesticide you are using. Consult the product label, Material Safety Data Sheets (MSDS), or manufacturer for this information. Check the company Web sites for MSDS information.

Protect Yourself When You Use Pesticides

- **Make sure someone knows** where you are working, what pesticides you are handling and how long you expect the job to take.
- **Post emergency numbers**, including the Poison Information Centre and Spills Action Centre, near all telephones.
- **Keep a list of the names and the Pest Control Products (PCP) Act Registration Numbers of all pesticides you handle.** Keep a file of the pesticide label booklets for all products you use. Make sure your co-workers and family members know where this list or file is in case of an accident.
- **Have plenty of clean water, soap and paper towels and an extra set of gloves and coveralls nearby at all times** in case a pesticide contaminates your clothing or skin.
- **Wear the correct protective clothing and equipment, and be sure all items are clean and in good repair, before you put them on.**
- **Never smoke, chew tobacco, eat or drink when you handle pesticides.** Never carry tobacco or food in your clothes and never leave tobacco, food or beverages in areas where you handle or store pesticides.

- **Change your clothes and wash your hands and face before you eat, drink or smoke.**

- **Wash your hands *before* you use the toilet, as well as after.** The skin in your groin area absorbs pesticides very easily.

Protect Other People, Livestock, Pets, Water and Sensitive Crops

- Buy and store only what you need.

- Prevent drift.

- Keep pesticides out of water.

- Clean up spills quickly and safely.

- Dispose of containers and waste pesticide safely.

Human Health

Risk = Toxicity X Exposure

Risks of Pesticide Use

Each time you handle a pesticide, you are at some risk. The amount of risk depends on 2 things: the toxicity of that pesticide and your exposure to it.

Toxicity is a measure of how harmful or poisonous the pesticide is. There are 2 types of toxicity:

- **Acute toxicity** is the toxic response that results from a **single exposure** to the pesticide. The symbols and words on the front panel of a pesticide label give you information about the acute toxicity.

Lethal Dose 50% (LD_{50}) is a measure of acute toxicity. It is the dose (mg of product/kg of body weight) that will kill 50% of the test animals within a stated period of time (24 hr, 7 days). **Those products with low LD_{50} ratings are highly toxic.**

Examples of products listed in this publication with a high acute toxicity include:

Common (active) name	Trade name
azinphos methyl	Guthion, Sniper
carbofuran	Furadan
disulfoton	Di-Syston
endosulfan	Thiodan, Thionex
fonofos	Dyfonate II
methomyl	Lannate
phorate	Thimet
terbufos	Counter

Examples of products listed in this publication with a moderate acute toxicity include:

Common (active) name	Trade name
chlorpyrifos	Lorsban, Pyrinex, Pyrifos
cyhalothrin-lambda	Matador
cypermethrin	Cymbush, Ripcord
deltamethrin	Decis
dimethoate	Cygon, Lagon
phosmet	Imidan
tefluthrin	Force

- **Chronic toxicity** is the toxic response that results from **repeated exposures** to small doses of a pesticide over a longer period of time. These toxic effects may not appear for months or years after exposure to the pesticide. The symbols on the label do NOT give information about the chronic toxicity of the product. Use protective clothing and equipment to help reduce exposure and the risk of chronic effects.

Cholinesterase Blood Tests

Organophosphorus and *carbamate* pesticides can affect your nervous system. These pesticides can change your serum and red blood cell levels of an enzyme called acetyl cholinesterase. Your body uses this enzyme to transmit messages through your nervous system. If your cholinesterase levels fall, you can experience symptoms including trembling, twitching, blurred vision, difficulty breathing and heart difficulties.

If you use any of the groups of pesticides listed below on a regular basis, you should have regular cholinesterase blood tests. Your family doctor can arrange these tests, which are covered by OHIP. Have your first test *before* you begin to handle these pesticides. That shows the baseline (normal) cholinesterase level for your body. During the spray season, if you are spraying organophosphorus or carbamate insecticides regularly for several weeks, have a cholinesterase blood test every **7–10 days**. If your cholinesterase level drops to below one-half of your baseline level, then you are showing signs of pesticide poisoning and **you must remove yourself from exposure** to these pesticides until your cholinesterase level returns to normal.

Common (active) name	Trade name
azinphos-methyl	Guthion, Sniper
carbaryl	Sevin
carbofuran	Furadan
chlorpyrifos	Lorsban, Pyrinex, Pyrifos
dimethoate	Cygon, Lagon
disulfoton	Di-Syston
fonofos	Dyfonate II
malathion	Malathion
methomyl	Lannate
phosmet	Imidan
phorate	Thimet
terbufos	Counter
trichlorfon	Dylox

Exposure is a measure of the contact you have with a pesticide. You can be exposed to a pesticide in 3 ways.

- **Dermal exposure** occurs through your skin or eyes. The amount and rate of pesticide that may be absorbed depends on several things, including:
  - your skin condition. If your skin is moist, or if you have rashes, broken skin or scratches, a pesticide will be absorbed more easily.
  - the part of your body that is exposed. Your eyes, genital area, scalp and ear canals absorb pesticides at a higher rate than your hands or arms. Your eyes absorb pesticides at a rate of 100%.
- **Respiratory exposure (inhalation)** occurs when you inhale small spray particles, dust, gases or vapours.
- **Oral exposure** occurs when a pesticide enters your mouth or you swallow a pesticide.

First Aid

1. Always protect yourself from injury first. Don't become another victim. Always put on protective clothing and equipment before you enter a contaminated area or handle a contaminated victim.

2. Check to see if the victim is breathing.

   If the victim is not breathing:
   - Straighten the victim's airway and check for breaths.
   - If the victim does not begin to breathe, administer artificial respiration until the victim begins to breathe on his/her own.
   - Do not contaminate yourself, especially if the victim has pesticide or vomit around his face or mouth. Use a face shield airway with a one way valve. Do not breathe the exhaled air from the victim.
   - Perform CPR if the victim's pulse disappears. Only perform CPR if you are trained to do so.

   If the victim is breathing, but unconscious:
   - Place the victim in the recovery position (on the side with the head turned slightly to one side). If the victim vomits, try to keep the airway clear.

3. Stop the exposure to the pesticide. Move the victim away from the contaminated area. Remove all contaminated clothing. Use soap and water to wash any skin exposed to the pesticide.

4. Check the Four Basic Facts:
   - **Identify the pesticide.** Look for the label, container or leftover pesticide.
   - **Quantity**. How much product was the victim exposed to?
   - **Route of entry.** How did the pesticide enter the body? Did it enter through the mouth, skin/eyes or lungs?
   - **Time period.** How much time has passed since the victim was exposed to the pesticide, and how long was the exposure? Were the symptoms immediate or did the poisoning occur as a result of using the pesticide over a longer period of time?

Don't waste time. If you can't answer these questions quickly, be ready to tell emergency personnel whatever you can.

5. Call an ambulance or the Poison Information Centre.

6. Start the first aid treatment appropriate for the route of entry.

7. **Make sure the patient gets medical attention.** First aid is **not** a substitute for professional medical help.

Emergency and First-Aid Procedures for Pesticide Poisoning (See inside back cover)

If symptoms of illness occur during or shortly after handling a pesticide, go to a hospital. Take the pesticide label, MSDS sheet, or pesticide container with you. Do not transport the container in the passenger compartment of the vehicle.

Pesticide Label Information

Know the Hazard Symbols and Words

Four important symbols and words show the potential hazards of pesticides.

Hazard Symbol	Signal Word
	Poison
	Corrosive
	Flammable
	Explosive

The hazard symbol always appears inside one of the shapes shown below. These shapes and their warning words tell you the degree of hazard of the pesticide. **The greater the number of sides to the shape, the more hazardous the product**.

	Warning Symbol	Signal Word
Triangular shape means low hazard (3 sides)		Caution
Diamond shape means moderate hazard (4 sides)		Warning
Octagonal shape means high hazard (8 sides)		Danger

Learn these symbols and words — they could save your life!

Check the label for special warnings about eye hazards and skin hazards. The front panel of the pesticide label may also contain warnings that tell you the product is corrosive to eyes, or is a skin or eye irritant.

Re-Entry Periods

Re-entry period is the minimum amount of time that must pass between the time the pesticide was applied and the time that workers can go into the crop area without wearing personal protective equipment. If workers enter treated areas without wearing protective equipment too soon after pesticides have been applied they may experience poisoning. Such poisoning can result from handling treated plants or from inhaling pesticide vapours. The list below shows a specific minimum interval that you must observe between applying the pesticide and working in the treated crop without protective equipment.

24 Hours	48 Hours
methomyl (Lannate)	azinphos-methyl (Guthion, Sniper)
	carbofuran (Furadan)[1]

[1] If prolonged direct contact with corn foliage will occur, do not enter treated fields within 14 days of application without wearing protective equipment.

Some pesticides, like parathion, have labels that carry a warning about working in treated crops. Follow the label recommendations.

Days to Harvest (Preharvest) Intervals, Pregrazing and Feeding Intervals

These intervals state the minimum amount of time that must pass between the last pesticide application and the harvesting of the crop, or the grazing or cutting of the crop for livestock feed. If you harvest a crop before the preharvest interval has passed, there may be pesticide residues in excess of the Maximum Residue Limits (MRL) set by Health Canada.

To avoid exceeding the Maximum Residue Limits, always follow the label.

Crop Rotation Statements

Some pesticides can persist in treated soil and crops sensitive to that pesticide may be injured if they are planted too soon after the treated crop is harvested. Some labels state a minimum waiting time that must pass before it is safe to plant sensitive crops.

Total Number of Applications

Some product labels state the total number of applications of that pesticide that can be made during a growing season. These limits prevent food residues, crop damage, soil residues or pest resistance.

Buffer Zones

Buffer zones are areas left untreated to protect an adjacent area, for example a pond, a stream, a sensitive crop, a non-target crop, wetland or woodland etc.

Protective Clothing and Equipment

Choose and Wear Appropriate Protective Clothing and Equipment

Make sure your protective clothing and equipment:

- is what you need for the job
- fits properly, and
- is clean and in good repair and working condition.

The protective clothing and equipment you need to wear depends on:

- **the pesticide you are using**. READ THE PRECAUTIONS SECTION OF THE LABEL TO KNOW WHAT TO WEAR.

- **the job you are doing**. For example, you need more protection when you handle concentrated pesticide, or when you mix and load your sprayer.

- **the type of application**. Enclosed space or air blast sprayer applications made with open tractors require more equipment.

Each person who is working with pesticides needs **their own** set of protective clothing and equipment. Consult the technical expert at your safety supply company to make sure that you purchase the appropriate equipment and that it fits the user.

For ALL pesticides, always wear:

- A water-repellent hat such as a hard hat or waterproof rain hat.
  - Where you need to protect your entire head and neck, for example applying pesticides in a greenhouse or applying dust formulations or using air-blast sprayers — wear a hood or hat that protects your ear canals.
  - Do not wear hats made from cloth.
  - Baseball-style caps absorb pesticides and are not safe.

- Long pants and a shirt with long sleeves, or a coverall.
  - Coveralls can be reusable or disposable. Reusable coveralls are normally cotton or polyester and should be tightly woven. Disposable coveralls should be designated for pesticide use.
  - Choose water-resistant coveralls. Cotton, denim and cotton-polyester fabrics can cling if wet and transfer pesticides to your skin. If you spill pesticide on your clothing, remove the clothing immediately.

- Chemical resistant gloves (unlined).
  - Use neoprene or nitrile gloves (PVC), unless the label states otherwise. Do not wear rubber gloves as many pesticides can break down the rubber material. Wear your gloves under your sleeves with the top cuffed.

- Chemical resistant boots (unlined).

Read the label. It describes what extra protective clothing and equipment to wear. For some pesticides you may also need to wear:

- goggles
  - Use safety goggles with indirect vents so splashes do not enter your eyes. Regular eyeglasses don't provide complete protection. Never wear contact lenses when you handle pesticides.

- face shield

- chemical resistant apron

- respirator
  - A respirator is a unit that covers your mouth and nose to prevent spray droplets, small particles, and vapours from getting into your lungs. **A dust mask is not a substitute for a pesticide respirator.** When you buy a respirator or replacement cartridges, make sure the cartridges and prefilters protect you against organic vapours. For more information about respirators, refer to the *Grower Pesticide Safety Course manual*, Ridgetown College, University of Guelph.

You may need more protection, such as **Canister Gas Masks or Self-Contained Breathing Apparatus (SCBA)** when you apply:

- any pesticide in an enclosed area, or
- fumigants, gases, vapours or smokes.

ALWAYS wear a respirator when you work with fumigants, gases or vapours, or when you apply any pesticide in an enclosed area.

Use **Organic Vapour Tractor Cab Cartridges.** If you use a tractor with a cab when you spray, the tractor cab cartridges work the same as an air-purifying respirator. These cartridges and prefilters **must** be replaced and maintained regularly to provide continued protection.

When you use **air-blast sprayers and mist blowers and tractors without cabs**:

- wear the appropriate respirator, as well as a waterproof suit, head covering, chemical resistant gloves,

boots, and eye protection. Once you complete the spray application, clean your protective equipment and the tractor. Do not operate the tractor without wearing protective clothing and equipment, unless it has been decontaminated.

Safety Supply Companies

Consult the safety supply company(s) of your choice for help in selecting your protective clothing and equipment. (See Table 1–1, *Safety Supply Companies in Ontario Providing Protective Clothing & Equipment*, on page 8.)

Care of Protective Clothing and Equipment

- After you complete the spray operation, clean all protective clothing and equipment.
- Never let children, pets or livestock come in contact with contaminated clothing or equipment. Make sure they do not come into contact with the puddles of water that result from cleaning your equipment.
- **Wash your gloves with soap and water, then *leave them on* to remove your other protective clothing and equipment.**
- Always remove protective clothing and equipment outdoors. If a granular pesticide was used, shake the clothing outdoors in a safe place, emptying pockets and cuffs.
- Throw out clothing contaminated by spills of highly toxic or concentrated pesticide. Place clothing in a plastic bag and take it to a landfill site.
- **Coveralls and other spray clothing must be washed separately from other clothes.** Wash after each use. Place them in a plastic bag and keep them separate.
- With your hands still protected by gloves, wash protective equipment. It is best to wash equipment outdoors. If you do not have an outside clean-up area, keep certain buckets just for equipment clean up. Mark them and keep them in a special place. Wash the inside and outside of your goggles, hat, boots, and any water-repellent clothing in warm soapy water, rinse well and let them air-dry.
- Remove the cartridges and prefilters from the respirator.
- Discard cartridges, canisters and filter pads when breathing becomes difficult, when you notice a pesticide taste or odour, or at the interval set by the manufacturer.
  - Note the date the cartridge is first used.
  - Remove cartridges and filter pads from the face piece and store in clean, sealed plastic bags.
  - Wash the face piece in warm soapy water, rinse thoroughly, and dry in a well-ventilated area. Air-drying prevents damage to the inlet and outlet valves.
  - Never use alcohol or other solvents for cleaning, as they damage the rubber and plastic.
- Next wash the outside of your boots and gloves with soapy water and remove them.
- After removing boots and gloves, wash them inside and out with detergent and water, rinse thoroughly, and dry in a well-ventilated area.
- Place all dry articles in a clean storage area until next use.

How to Wash Your Spraying Clothes

Never mix spray clothing with household laundry. All clothing used for spraying must be stored and washed separately from other clothing. Wash after each use. Remember to use chemical resistant gloves to handle pesticide-contaminated clothing.

- Presoak clothing before washing. Use 1 of 3 methods:
  - hose-off garments outdoors
  - soak in separate tub or pail
  - use the prewash cycle in automatic washer.
- Place clothing directly into the washing machine. Wash only a few garments at a time. Do not wash with other family clothes.
- Use hot water, the highest water level, and the longest cycle, with heavy duty detergent. Wash as you would for heavily soiled clothing.
- Wash clothing again.
- After washing, hang outside (preferably in bright sunlight) until completely dry. Do not use the clothes dryer.
- Clean the washing machine. Run the washing machine through one complete cycle using only detergent and hot water. (No clothing.)

TABLE 1–1. Safety Supply Companies in Ontario Providing Protective Clothing & Equipment

3-M Canada Inc.	Occupational Health and Environmental Safety, Box 5757 London, ON N6A 4T1	(519) 452-6165 1-800-364-3577 Fax: (519) 452-4660
Acklands Grainger	90 W. Beaver Creek Rd. Richmond Hill, ON L4B 1E7	(905) 731-5516 1-800-668-8989 Fax: (905) 731-2798
Aearo Canada	7115 Tomken Rd. Mississauga, ON L5S 1X7	(905) 795-0700 1-800-387-4304 Fax: (905) 564-5250
Dutch Industries Protect-Air Cab Filter	Huron Tractor, Box 1300 Exeter, ON N0M 1S3	(519) 235-1115 Fax: (519) 255-1939
HAMISCO	3392 Wonderland Rd. London, ON N6L 1A8	(519) 652-9800 1-800-668-9800 Fax:(519) 652-9661
Kappler Canada	Box 1687 20 Ryan Place Brantford, ON N3T 5V7	(519) 752-4369 1-800-387-9326 Fax: (519)752-2161
Levitt-Safety (Eastern) Limited	2872 Bristol Circle Oakville, ON L6H 5T5	(905) 829-3299 1-800-668-6153 Fax: (905) 829-2919
MSA Canada Inc.	148 Norfinch Dr. North York, ON M3N 1X8	(416) 667-9400 1-800-267-0672 Fax: (416) 663-5908
Mitt & Robe Co.	751 Norfolk St. N. Simcoe, ON N3Y 3R6	(519) 428-4050 1-877-893-6565 Fax: (519) 428-5142
Plant Products Co. Ltd.	314 Orenda Road Brampton, ON L6T 1G1	(905) 793-7000 1-800-387-2449 Fax: (905) 793-9632
Safety Express	4060B Sladeview Cres., Unit 2 Mississauga, ON L5L 5Y5	(905) 608-0111 1-800-465-3898 Fax: (905) 608-0091
The St. George Company (Suppliers of Kasco Helmets)	P.O. Box 430 20 Consolidated Drive Paris, ON N3L 3T5	(519) 442-2046 1-800-461-4299 Fax: (519) 442-7191

Personal Hygiene

- **Always wash your hands before eating, drinking or smoking.**
- **When you are finished for the day, take a bath or shower as soon as possible.** The longer a pesticide remains on your skin, the greater the risk it will be absorbed into your body.
- Wash your hair and under your fingernails. Shower with lots of soap and water.
- Always change into clean clothes.
- Wear clean work clothes every day. A small spill on the previous day's clothes may seem unimportant, but wearing the same clothing again without washing it prolongs the exposure and increases your risk.

Protect the Environment

Protect Water Sources

- You must use an anti-backflow device to prevent back siphoning when drawing water from wells, ponds, streams or other sources.
- Mix pesticide and load the sprayer **away** from any water supply, including wells, ponds or streams.
- Use buffer zones (untreated areas) when you apply pesticides to avoid contaminating surface water, wells, ponds and/or streams. Check the product label for specific buffer zone distances.

Reduce and Manage Pesticide Spray Drift

Spray only when winds are light to moderate. If you notice drift is occurring because of the wind, **stop spraying** until the wind subsides. Do not apply pesticides if the wind is blowing towards susceptible crops or environmentally sensitive areas such as watercourses.

- Read the product label for information regarding buffer zones, water volumes and recommended nozzles.
- Use buffer zones around all watercourses, wells and neighbouring fields that contain sensitive crops. If the label does not state a specific buffer zone distance, leave an untreated area of natural vegetation.
- Select the recommended sprayer application rate (L/ha).
- Select the correct nozzle. Where practical, use air induction/venturi nozzles. These nozzles significantly reduce drift when compared to conventional nozzles.
- Select the correct nozzle-to-target distance.
- Use spray-plume protection where practical or available (hoods, shrouds, screens and air curtains).
- Use drift-reducing adjuvants in the spray tank as directed by the label.
- Utilize wick weeders, instead of spraying, when possible.

For more information about spray drift consult OMAF/Agriculture and Agri-Food Canada booklet *Best Management Practices Pesticide Storage, Handling and Application* and the Ontario Pesticide Education Program (Ridgetown College) videos *How to Manage Spray Drift* and *Spray Drift Reduction through Air Induction.*

Prevent Bee Poisoning

It is important to protect bees when you spray. Honeybees, as well as other bees and insects, are important pollinators of crops. Many crops also offer bees important sources of pollen for honey production.

If you choose to use insecticides for insect control, take these steps to prevent harming bees when you spray:

- Before you apply a pesticide, advise local beekeepers so that they can move colonies out of the danger area. Contact the Provincial Apiarist at 1-888-466-2372 for a list of the beekeepers in your area.
- Do not spray any flowering crop on which bees are foraging. If you must apply insecticides, spray after 7 p.m. when the bees are not foraging. If this is not a possibility, spray before 7 a.m. Bees usually do not forage at temperatures below 13°C.
- Do not apply insecticide on windy days to prevent drift toward any nearby hives.
- When there is a choice, choose the product formulation that is less hazardous to bees. Dusts are more toxic than sprays. EC formulations are less toxic than WP formulations.
- Under the *Bees Act* it is an offence to spray in orchards while there is bloom on the trees.

Most organophosphate and carbamate insecticides are highly toxic to bees. Examples of insecticides used in crop production that are toxic to bees are listed below.

TABLE 1–2. Relative Toxicity of Insecticides to Honeybees

Group 1 – Very toxic. Do not apply to flowering crops or weeds	
Basudin, Diazinon	diazinon
Cygon, Lagon	dimethoate
Furaden	carbofuron
Guthion, Sniper	azinpho-methyl
Imidan	phosmet
Lannate	methomyl
Lorsban, Pyrinex	chlorpyrifos
Malathion	malathion
Ripcord	cypermethrin
Sevin	carbaryl
Group 2 – Apply only during late evenings or early morning*	
Decis	deltamethrin
Dylox	triclorfon
Endosulfan, Thiodan	endosulfan

* Usually low temperatures at time of application may cause insecticides to remain toxic up to 20 times longer than during warm weather. High temperatures in the early morning or late evening may extend active foraging by bees.

Read each pesticide label for specific precautions regarding bees.

Disposal of Pesticides and Empty Pesticide Containers

Triple or Jet Rinse Your Empty Pesticide Containers

Unrinsed pesticide containers are not really empty. They may still hold about 1% of the original amount of pesticide. Although this figure sounds low, it is still a hazard to humans, animals, and the environment.

To reduce the hazard, rinse each container 3 times as the spray tank is filling. Use either the manual triple-rinse technique, or a specially designed device for rinsing containers. Paper or cardboard containers are often strong enough to be rinsed. If it is possible, rinse these containers as well as plastic ones.

To Triple Rinse

1. Fill the empty container at least 10% full with the diluting material (usually water).

2. Cap, then shake or roll the container so that the inside surfaces of the container are well rinsed.

3. Pour rinsings into the spray tank.

4. Repeat steps 1–3 twice more.

Remember to check the container after you have finished rinsing. Make sure no pesticide has been left behind as a cake or paste on the bottom of the container.

Rinsing Devices

Rinsing devices use pressurized water to clean the container. They are just as effective as triple rinsing but take less time. Follow the manufacturer's instructions.

How to Dispose of Empty, Triple-Rinsed Containers

Never reuse empty pesticide containers. They may be handy, but there is still some risk, even if the containers are triple rinsed. Never give empty, rinsed containers to anyone, especially children. Dispose of them promptly.

Regulation 914 of the *Pesticides Act* regulates how pesticide containers are to be disposed of in Ontario. [Reg. 914, s. 27]

For Metal, Plastic, or Glass Containers

Dispose of an empty metal, plastic, or glass container that has been used to hold a Schedule 1, 2, 3*, 5 or 6* (*non-domestic) pesticide by triple rinsing or jet rinsing using clean water, or another appropriate solvent

AND either

- taking it for recycling to a pesticide container depot

OR

- taking it to a licensed waste disposal site.

Once properly rinsed, puncture the containers so they cannot be reused and to make sure the rinse water is totally out of the container.

It is often more convenient to store empty, rinsed containers until you have collected enough to make a trip to the recycling pesticide container depot or the waste disposal site. If you store containers, keep them in a dry safe place, such as the storage area, until you can dispose of them properly.

Recycling

The Ontario Pesticide Container Recycling Program is available to growers and commercial applicators. Through this program, **clean, triple rinsed, plastic/metal pesticide containers** (up to 23 L in size for plastic and 20 L in size for metal) can be returned to pesticide container depots located throughout the province. To locate the pesticide container recycling

depot closest to you, call the Ontario Pesticide Education Program at 1-800-652-8573.

Future Farm Supply in Aylmer has a recycling pesticide container depot to collect empty metal drums that contained sucker oil and fumigants used in tobacco and fruit production.

For Paper and Cardboard Containers

Dispose of a paper or cardboard container that has been used to hold a Schedule 1, 2, 3*, 5 or 6* (*non-domestic) pesticide by triple rinsing or jet rinsing (if possible) using clean water

AND either

- burning, (if allowed by municipal by-laws) in circumstances that persons and animals are kept out of any smoke produced and any smoke is directed away from buildings, highways, roads, or outdoor areas frequented by the public

OR

- taking it to a licensed waste disposal site.

Paper or cardboard containers are often rigid enough to withstand rinsing. If possible, triple rinse these containers as you fill the tank. Then burn the containers in an isolated area on your farm.

Be very careful around the smoke. It may contain toxic fumes from the burning pesticide. Be certain there is no chance that a person or animal may breathe in this smoke. Make sure the smoke does not drift toward buildings, roads, or any public outdoor areas.

These containers can also be taken to a local waste disposal site in the same way as metal, plastic, or glass containers. If you can't dispose of them immediately, make sure containers are kept in a secure place such as the pesticide storage area.

Unwanted Pesticides

If you have pesticides you do not need or cannot use, be sure to dispose of them safely.

- Contact the supplier. It is sometimes possible to return unused pesticide if it is still in its original container.

- If you cannot find any way to use the product as shown on the label, then the Ministry of the Environment requires that waste be disposed of by licensed waste haulers to a licensed waste disposal site. Look in the Yellow Pages under Liquid Waste Removal.

- Watch your local paper for Municipal Waste Collection Days or contact your municipality. If your municipality has no waste collection days, encourage them to sponsor such an event. On these days, you can turn over surplus pesticide concentrates (maximum 25 L) for disposal.

Surplus Spray Mix

The best way to dispose of any excess spray mix is to find other fields that require an application of this pesticide. Before spraying, check the label to make sure the pesticide is registered for use on that crop.

If you can't find another field to spray, then dilute the remaining spray mix by adding 10 parts of water for each 1 part of spray mix. This diluted solution can be safely applied to the treated area as long as you do not exceed the pesticide rate recommended on the label. Be sure to check the label for any restrictions about crop rotation, days to harvest, or surplus spray mix disposal.

NEVER respray the treated field with undiluted spray mix. Spraying an area twice will double the recommended pesticide rate. This may cause illegal pesticide residues in the harvested crop or harmful residues in the soil that can cause crop damage.

Soluble Packaging Options

Choose soluble packages that dissolve in the spray tank to reduce container disposal. Water-soluble packaging is used for dry flowable and wettable powder formulations of pesticides and is available under names such as Clean Pak, Solupak, and Toss-N-Go. In most cases, the water-soluble packaging material is PVA (polyvinyl alcohol). This material dissolves completely when added to the water in the sprayer tank according to instructions.

Read all labels and instructions carefully. For more details contact your vendor.

Storing Pesticides

Ontario's *Pesticides Act* and Regulation 914 give storage requirements for storage facilities. The storage requirements you must follow depend on which Schedules of pesticides you store. See also OMAF Factsheet, *Pesticide Handling Facilities*, Order No. 94-037.

***Pesticides Act* Storage Requirements**	Sch. 3, 4 & 6	Sch. 2	Sch. 1 & 5
No contact with food or drink	◆	◆	◆
Not impair health/safety	◆	◆	◆
Clean & orderly manner	◆	◆	◆
Warning signs posted on storage buildings	◆	◆	◆
Warning signs posted on unattended vehicles	◆	◆	◆
Emergency telephone numbers posted	◆	◆	◆
Ventilated to outside		◆	◆
Limited access (locked)		◆	◆
No floor drain		◆	◆
Safety equipment available		◆	◆
Area used exclusively for pesticides			◆

Pesticide Spills

Protect yourself before you begin to clean up any spill. Clean up spills immediately.

In the case of minor spills:

- for liquids, cover the spill with a thick layer of absorbent material such as kitty litter, vermiculite or dry soil. Sweep or shovel the material into a waste drum.
- for powders and granulars, sweep or shovel the material into a waste drum.

In the case of a major spill:

- **remove any people or animals from the spill area**
- stop the spill from spreading
- do not let the pesticide enter any watercourse.

For information on preventing spills see OMAF Factsheet, *Ways to Avoid Pesticide Spills*, Order No. 96-025. If a well becomes contaminated, follow the clean-up instructions in OMAF Factsheet, *Pesticide Contamination of Farm Water Supplies*, Order No. 00-099. (See inside front cover for information on how to obtain factsheets.)

If a pesticide spill causes, or is likely to cause, an adverse effect, you must notify the Ministry of the Environment, Spills Action Centre at 1-800-268-6060 (24 hrs a day, 7 days a week) and the municipality.

Application Procedures

Sprayers

- Sprayers that can deliver enough litres per hectare for adequate coverage are satisfactory for applying emulsion-type insecticides.
- If 2,4-D or related herbicides are used, clean the sprayers thoroughly with detergent containing ammonia to prevent crop damage.
- Adequate agitation is essential when applying wettable powder formulations.
- Pumps should be capable of delivering the flow and pressure required as well as being compatible with materials sprayed.
- Keep in mind that the higher the pressure, the greater the danger of drift to other crops.
- Calibrate your sprayer at least twice during the growing season with each set of nozzles used. The wear on nozzles and other parts will alter the amount of spray delivered.
- Check all nozzles for flow rate at least once a year. Replace nozzles when their output is 10% greater than rated output.
- For information on calibration, see the current OMAF Publication 75, *Guide to Weed Control*. See calibration calculator on the OMAF Web site.

General Precautions and Requirements for Fumigants (Gases, Vapours and Fumes/Smokes)

Read and follow all instructions on the product label regarding protective clothing and equipment, aeration of treated areas, and re-entry periods.

- Lock the building and post warning signs.
- If you use a fumigant gas, such as methyl bromide plus chloropicrin or aluminum phosphide to fumigate a structure, you must hold the appropriate license and obtain a permit issued under Ontario's *Pesticides Act*. To apply for a permit, contact the regional pesticides officer with the Ontario Ministry of the Environment.
- As a safety precaution, have someone else who is wearing personal protective equipment help with the fumigation. (This is a requirement for all fumigant gas use.)
- Do not wear gloves when you handle methyl bromide. You must wear a self-contained positive pressure breathing apparatus.

- When you handle aluminum phosphide, use cotton gloves and wear a full-face mask respirator with an acid gas canister, or a self-contained positive-pressure breathing apparatus.

For more information, obtain *Structural Fumigation Procedures* (September 1998 edition) from the Ontario Ministry of the Environment.

Band Spraying

Check the product label under Directions for Use. Some labels give specific nozzle recommendations and formulas to determine band application rates.

You need to decide how much spray mix to prepare so that you will apply the recommended rate over the band area. To know how much to mix, you will first need to calculate the size of the entire treated area.

To calculate the total area of all the treated bands:

$$\text{Total Band Area (ha or acres)} = \text{Total area of Planted Field (ha or acres)} \times \frac{\text{Band Width (cm or in)}}{\text{Row Spacing (cm or in)}}$$

Seed Treatments

Remember that seed treatment products are also pesticides.

- Seed dressings and seed treatments are poisonous to people and animals.
- Wear protective clothing and equipment when you are treating seed, or handling treated seed. Protect your skin — wear a long-sleeved shirt and long pants or coveralls and wear neoprene or nitrile gloves. Protect your eyes with goggles and/or a face shield. Wear a respirator to protect your lungs from dusts and vapours.
- Wash thoroughly after finishing the treatment, or handling the treated seed.
- Never feed treated seed to animals.
- Keep treated seed out of the reach of children.
- Destroy all the bags that have held treated seed as recommended in the container disposal section by burning or by taking to a licensed waste disposal site.

See Table 1–3, *Seed Treatments*, on page 14 for a list of seed treatments recommended in this publication.

Aerial Application by Airplane or Helicopter

Any person who applies pesticide from an aircraft in Ontario must hold an Aerial exterminator licence. In addition, a permit is required to purchase and apply pesticides by air for the following:

- applications to surface water(*), e.g., ponds, lakes, rivers; * **A permit is required for all means of pesticide application to surface water.**
- applications to forests as defined in the *Crown Forest Sustainability Act*
- applications of any Schedule 1 or 5 pesticide or a Schedule 2 pesticide containing 2,4-D, 2,4-DB, mecoprop, MCPA, MCPB, dichlorprop, dicamba, picloram, paraquat or trichlopyr.

Be sure that any pesticide you apply by air has specific instructions for aerial use on the label. Take extra precautions when using insecticides applied by air that are toxic to honeybees, such as Sevin (carbaryl).

See Table 1–4, *Fungicides*, on page 16 and Table 1–5, *Insecticides*, on page 17 for a list of the fungicides and insecticides recommended in this publication.

TABLE 1–3. Seed Treatments

TRADE NAME	Active Ingredient	Chemical Family	Risk of Resistance Developing*	Formulation	Crops	Manufacturer	Ontario Schedule[1]
Fungicides							
Anchor	carbathiin + thiram	anilide + dithiocarbamates	low	F (DB)	soybeans	Gustafson Partnership	3
Allegiance FL	metalaxyl	acylamine	medium	F	soybeans, forages, corn, cereals, canola	Gustafson Partnership	3
Apron FL	metalaxyl	acylamine	medium	F	soybeans, forages, corn, cereals, canola	Gustafson Partnership	3
Apron XL LS	metalaxyl-M	acylamine	medium	LS	soybeans, corn, canola, wheat, forages, beans	Syngenta Crop Protection	2
Baytan 30	triadimenol	triazole	low to medium	F	wheat, barley	Gustafson Partnership	3
Captan FL	captan	phthalimide	low	F	beans, corn, soybeans	Norac Concepts Inc.	2
Dividend XL	difenoconazole + metalaxyl-M	triazole + acylamine	low to medium	F	wheat	Syngenta Crop Protection	2
Dividend XL RTA	difenoconazole + metalaxyl-M	triazole + acylamine	low to medium	F	wheat	Syngenta Crop Protection	2
Maxim 480FS	fludioxonil	phenylpyrrole	low	F	corn, soybeans	Syngenta Crop Protection	2
Raxil 250 FL	tebuconazole	triazole	low to medium	F	wheat, barley, oats	Gustafson Partnership	2
Thiram 75 WP	thiram	dithorcarbamates and relatives	low	P	alfalfa	Gustafson Partnership	2
Vitaflo 280	carbathiin + thiram	anilide + dithiocarbamates	low	F	barley, wheat, oats, flax, dry common beans, soybeans, rye, corn	Gustafson Partnership	3
Vitavax RS Fungicide	carbathiin + thiram	anilide + dithiocarbamates	low	F	canola, mustard, rapeseed	Gustafson Partnership	2
Insecticides							
Gaucho 480 FL	imidacloprid	chloronicotine	medium to high	F	canola, mustard, seed corn only	Gustafson Partnership	5

DB = Drill Box Application EC = Emulsifiable Concentrate F = Flowable LS = Liquid Suspension P = Powder

[1] The numbers identify the Schedules in which the TRADE NAME products listed in this table are classified under the *Pesticide Act*. See Appendix C, *Ontario Classification Schedules*, on page 68 for an explanation of schedules.

* risk of resistance based on continuous use of product

TABLE 1–3. Seed Treatments (Cont'd)

TRADE NAME	Active Ingredient	Chemical Family	Risk of Resistance Developing*	Formulation	Crops	Manufacturer	Ontario Schedule[1]
Fungicides With Insecticides							
Agrox B-2	diazinon + captan	organophosphate + phthalimide	low	P (DB)	corn, beans, soybeans	Norac Concepts Inc.	2
Agrox B-3	diazinon + lindane + captan	organophosphate + organo-chlorine+ phthalimide	low	P (DB)	corn, beans, soybeans	Norac Concepts Inc.	2
Agrox CD	diazinon + captan	organophosphate + phthalimide	low	P (DB)	corn, beans, soybeans	Norac Concepts Inc.	2
Agrox D-L Plus	diazinon + lindane + captan	organophosphate + organo-chlorine+ phthalimide	low	P (DB)	corn, beans, soybeans	Norac Concepts Inc.	2
D.L.+ C.	diazinon + lindane + captan	organophosphate + organo-chlorine+ phthalimide	low	P (DB)	corn, beans, soybeans	United Agri Products	2
DCT	diazinon + captan + thiophanate-methyl	organophosphate + phthalimide + benzimidazole	low	P (DB)	dry common beans	Norac Concepts Inc.	3
Gaucho CS	imidacloprid + carbathiin + thiram	chloronicotine + anilide + dithiocarbamates	low to medium	F	canola, mustard, rapeseed	Gustafson Partnership	
Helix Xtra	thiamethoxam + difenoconazole + metalaxyl-M + fludioxonil	chloronicotine+ triazole + acylamine + phenylpyrrole	low to medium	F	canola, mustard	Syngenta Crop Protection	2
Vitaflo Dual Purpose	carbathiin + thiram + lindane	anilide + dithiocarbamates + organo-chlorine	low	F	wheat, barley	Gustafson Partnership	2

DB = Drill Box Application EC = Emulsifiable Concentrate F = Flowable LS = Liquid Suspension P = Powder

[1] The numbers identify the Schedules in which the TRADE NAME products listed in this table are classified under the *Pesticide Act*. See Appendix C, *Ontario Classification Schedules*, on page 68 for an explanation of schedules.

* risk of resistance based on continuous use of product

TABLE 1–4. Fungicides

TRADE NAME	Active ingredient	Fungicide Classification	Days to Harvest	Relative Toxicities	Aerial Application	Manufacturer	Use and Remarks	Ontario Sch.[1]
Benlate 50 WP Benlate Toss-N-Go WP	benomyl	benzimidazole	14 14	low	yes	Dupont Canada	field beans canola	3
Botran 75 W	dichloran	nitroaniline	2	low	yes	Gowan Company	field beans	3
Dithane DG Rainshield	mancozeb	dithiocarbamate	40	low	yes	Dow AgroSciences	spring and winter wheat, alfalfa	3
Quadris	azoxystrobin	stobilurin	30	low	yes	Syngenta Crop Protection	canola, seed corn	2
Ronilan DF	vinclozolin	dicarboximide	45 40	low	yes	BASF Canada	dry edible beans, canola	3
Rovral WP	iprodione	dicarboximide	14	low	yes	Bayer CropScience	field beans, canola	3
Senator 70 WP	thiophanate-methyl	benzimidazole	14	low	yes	Engage Agro	white beans	3
Tilt 250E	propiconazole	triazole	14 corn 45 cereals 60 canola	low	yes	Syngenta Crop Protection	wheat, oats, barley, corn, canola, soybeans (for seed only)	2

E = Emulsifiable Concentrate EG = Extruded Granular F = Flowable WP = Wettable Powder

[1] The numbers identify the Schedules in which the TRADE NAME products listed in this table are classified under the *Pesticide Act*. See Appendix C, *Ontario Classification Schedules*, on page 68 for an explanation of schedules

TABLE 1–5. Insecticides

TRADE NAME	Active ingredient	Insecticide Classification	Days to Harvest	Relative Toxicities	Aerial application	Manufacturer	Use and Remarks	Ontario Sch.[1]
Counter 15G, 5G	terbufos	organo- phosphorus	planting time only	high	no	BASF Canada	corn, canola, mustard	5
Cygon 4 E	dimethoate	organo- phosphorus	2 alfalfa 7 beans	moderate	yes	Inter- Provincial Co-operatives Organization	alfalfa, field beans, soybeans. Toxic to bees.	2
Cymbush 250 EC	cypermethrin	pyrethroid	30 canola 5 corn	moderate	yes	Syngenta Crop Protection	corn, canola, mustard Toxic to bees.	2
Decis 5.0 EC	deltamethrin	pyrethroid	14 canola 1 corn	moderate	yes	Bayer CropScience	canola, corn, mustard Toxic to bees.	2
Dipel 2X DF	*Bacillus thuringiensis*	bacterial toxin	0	low	yes	Valent BioSciences	timothy, corn	3
Dylox 420 Liquid	trichlorfon	organo-phosphorus	21 cereals canola	low	yes	Bayer CropScience	canola, alfalfa, corn, cereals. Relatively safe to bees.	3
Force 3 G	tefluthrin	pyrethroid	planting time only	moderate	no	Syngenta Crop Protection	corn	2
Furadan 480 F	carbofuran	carbamate	60 canola	high	yes	Bayer CropScience	canola, mustard Toxic to bees.	5
Guthion 240 SC Guthion Solupak 50 WP	azinphos-methyl	organo-phosphorus	21 alfalfa, clover 30 rye	high	yes	Bayer CropScience	alfalfa, clover, rye Toxic to bees.	5
Imidan 50 WP	phosmet	organo-phosphorus	7	moderate	yes	Gowan Company	alfalfa Toxic to bees.	3
Lagon 480 EC	dimethoate	organo-phosphorus	7 beans, 28 alfalfa, 21 canola, 2 cereal	moderate	yes	United Agri Products	soybeans, beans, canola, alfalfa, cereals Toxic to bees.	2
Lannate Toss-N-Go 90 SP	methomyl	carbamate	20 cereals 8 canola	high	yes	Dupont Canada	cereals, canola Toxic to bees.	2
Lorsban 4 E, 15 G	chlorpyrifos	organo-phosphorus	70 corn, 21 canola 60 wheat	moderate	yes	Dow AgroSciences	corn, cereals, canola Toxic to bees	2, 3
Malathion 500 EC	malathion	organo-phosphorus	7 alfalfa, cereals, corn, 3 beans	low	yes	UCO, United Agri Products	alfalfa, cereals, field beans, soybeans, corn. Toxic to bees. Less effective below 20°C.	3

E = Emulsifiable Concentrate EG = Extruded Granular F = Flowable WP = Wettable Powder

[1] The numbers identify the Schedules in which the TRADE NAME products listed in this table are classified under the *Pesticide Act*. See Appendix C, *Ontario Classification Schedules*, on page 68 for an explanation of schedules.

TABLE 1–5. Insecticides (Cont'd)

TRADE NAME	Active ingredient	Insecticide Classification	Days to Harvest	Relative Toxicities	Aerial application	Manufacturer	Use and Remarks	Ontario Sch.[1]
Matador 120 E	cyhalothrin-lambda	pyrethroid	14 corn, 50 canola, 28 wheat	moderate	yes	Syngenta Crop Protection	corn, canola, alfalfa, wheat, barley, oats	5
Pounce EC	permethrin	pyrethroid	1 canola	moderate	yes	FMC Corp.	canola, cereals, corn, flax, sunflowers	3
Pyrifos 15G	chlorpyrifos	organo phosphorus	Planting time only	moderate	no	United Agri Products	corn	5
Pyrinex 480 EC	chlorpyrifos	organo phosphorus	7 corn, 60 cereals 21 canola	moderate	yes	United Agri Products	corn, canola, cereals Toxic to bees.	2
Ripcord 400 EC	cypermethrin	pyrethroid	30 canola wheat 5 corn	moderate	yes	BASF Canada	canola, corn, wheat Toxic to bees.	2
Sevin XLR Plus	carbaryl	carbamate	5 beans, 2 alfalfa, 14 oats, wheat 28 barley 1 corn	moderate	yes	Bayer CropScience	alfalfa, cereals, beans, corn, canola Toxic to bees.	3
Sniper	azinphos-methyl	organo- phosphorus	21 alfalfa, clover, 30 rye	high	yes,	United Agri Products	alfalfa, clover, rye Toxic to bees.	5
Thimet 15 G	phorate	organo- phosphorus	Planting time only	high	no	BASF Canada	corn	2
Thiodan 4 EC	endosulfan	organo- chlorine	2 beans 50 corn 30 alfalfa, rye	moderate	yes	Bayer CropScience	field beans, corn, alfalfa, rye Toxic to bees.	2
Thionex EC	endosulfan	organo-chlorine	2 beans 50 corn 30 alfalfa, rye	moderate	no	United Agri Products	field beans, corn, alfalfa, rye. Toxic to bees	2
Thuricide HPC	*Bacillus thuringiensis*	bacterial toxin	0	low	yes	Thermo Trilogy	timothy	3

E = Emulsifiable Concentrate EG = Extruded Granular F = Flowable WP = Wettable Powder

[1] The numbers identify the Schedules in which the TRADE NAME products listed in this table are classified under the *Pesticide Act*. See Appendix C, *Ontario Classification Schedules*, on page 68 for an explanation of schedules.

TABLE 1–6. Transgenic Crops Expressing Insecticidal or Fungicidal Traits

TRADE NAME	Event	Cry Protein (delta endotoxin)	Bt strain	Manufacturer	Pests Controlled	Remarks
Insecticides						
Corn						
Herculex I	TC1507	Cry 1F	*Bacillius thuringiensis* var. *aizawai*	Dow AgroSciences/ Pioneer Hi-Bred International	European corn borer Black cutworm* Fall armyworm	* May only provide control of young larvae.
KnockOut	Event 176	Cry 1Ab	*Bacillius thuringiensis* var. *kurstaki*	Syngenta Seeds Canada	European corn borer	May not provide complete protection against 2nd generation ECB. Does not protect against ECB damage to the ear.
NatureGard	Event 176	Cry 1Ab	*Bacillius thuringiensis* var. *kurstaki*	Dow AgroSciences/ Mycogen Seeds	European corn borer	May not provide complete protection against 2nd generation ECB. Does not protect against ECB damage to the ear.
Yieldgard	MON810	Cry 1Ab	*Bacillius thuringiensis* var. *kurstaki*	Monsanto Canada Inc.	European corn borer	
Yieldgard	BT11	Cry 1Ab	*Bacillius thuringiensis* var. *kurstaki*	Syngenta Seeds Canada	European corn borer	

2. Corn (Field and Seed)

INSECTS

TABLE 2–1. Corn (Field and Sweet) Seed and Soil Applied Insecticide Recommendations

Active Ingredients	Trade Name	Formulation	Corn Insects			
			Corn Rootworms	Wireworms	Seedcorn Maggot	Black Cutworm
SEED TREATMENTS						
Untreated Seed						
diazinon + captan	Agrox B-2	P (DB)	—	—	+	—
diazinon + lindane + captan	Agrox B-3	P (DB)	—	+	+	—
imidacloprid	Gaucho 480 FL	F	—	+	—	—
Seed Pretreated With Fungicide						
diazinon + captan	Agrox CD	P (DB)	—	—	+	—
diazinon + lindane + captan	Agrox D-L Plus	P (DB)	—	+	+	—
diazinon + lindane + captan	DL+C	P (DB)	—	+	+	—
SOIL APPLIED TREATMENTS						
chlorpyrifos	Lorsban 15 G	G	+	—	—	—
chlorpyrifos	Pyrifos 15 G	G	+	—	—	—
phorate	Thimet 15 G	G	+	—	—	—
tefluthrin	Force 3 G	G	+	+	+	S
terbufos	Counter 15 G	G	+	+	+	—

DB = Drill Box Application F = Flowable G = Granular P = Powder

+ = recommended for insect listed — = NOT recommended S = suppression

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
CORN ROOTWORM				
Soil Applied at Planting Only			**per 100 m (328 ft) row**	
Avoid planting corn on corn. Crop rotation is the best strategy for control. Risk factors include: heavier soil (clay), high beetle populations in corn of previous season, being the latest field planted in the previous season. If there is less than 1 beetle per corn plant on average throughout the month of August, then no insecticide is necessary in the following corn crop. In-furrow application is safer to the applicator and non-target animals then T-band application.	tefluthrin	Force 3 G	37.5 g	May be applied in a T-band or in-furrow. For banded applications, place directly over the furrow in a 15 cm band ahead of the press wheel. In-furrow application, place all material directly in the open seed furrow, behind the planter disc openers.
	terbufos	Counter 15 G	75 g	Lock and load. May be applied in a T-band or in-furrow. For banded applications, place directly over the furrow in a 15 cm band ahead of the press wheel. In-furrow application, place all material directly in the open seed furrow, behind the planter disc openers.
	chlorpyrifos	Lorsban 15 G Pyrifos 15 G	75 g 75 g	Must be applied in a 10–15 cm band over the row behind the planter shoe, in front of the press wheel. Do not place in direct contact with seed.
	phorate	Thimet 15 G	75 g	Lock and load. Must be applied in a 10–15 cm band over the row behind the planter shoe, in front of the press wheel. Do not place in direct contact with seed.
WIREWORMS				
Seed Treatment			**per 100 kg seed**	
Expect only 60%–70% control using seed treatments. Risk factors include: history of cereal/corn/grassy weeds, sandy soils, history of wireworm problems, coming out of sod. Threshold is one wireworm per bait trap. For bait trap information, see OMAF Publication 811, *Agronomy Guide for Field Crops*.	diazinon + lindane + captan	Agrox B-3	340 g	For all seed treatments use full rate and ensure good coverage of seed. Available as 2 kg container and will treat 600 kg of corn seed. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
		Agrox D-L Plus	200 g	Available as a 600 g container and will treat 300 kg of corn seed. Use this product only on seed previously treated with captan or thiram. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
		DL + C	200 g	Use this product only on seed previously treated with captan or thiram. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
	imidacloprid	Gaucho 480 FL	520 mL	**For seed corn only.** For use in commercial seed treaters only.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
WIREWORMS (CONT'D)				
Soil Applied at Planting Only			**per 100 m (328 ft) row**	
In-furrow application is safer to the applicator and non target animals then T-band application.	tefluthrin	Force 3 G	37.5 g	In-furrow only. Place directly in the seed furrow behind the planter disc openers.
	terbufos	Counter 15 G	75 g	May be applied in a T-band or in-furrow. For banded applications, place directly over the furrow in a 15 cm band ahead of the press wheel. In-furrow application, place all material directly in the open seed furrow, behind the planter disc openers.
SEEDCORN MAGGOT				
Seed Treatment			**per 100 kg seed**	
Seedcorn maggot problems in corn are extremely rare in Ontario. Expect only 60%–70% control using seed treatments.	diazinon + lindane + captan			For all seed treatments use full rate and ensure good coverage of seed.
		Agrox B-3	340 g	Available as 2 kg container and will treat 600 kg of corn seed. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
		Agrox D-L Plus	200 g	Available as a 600 g container and will treat 300 kg of corn seed. Use this product only on seed previously treated with captan or thiram. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
		DL + C	200 g	Use this product only on seed previously treated with captan or thiram. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
				For all seed treatments use full rate and ensure good coverage of seed.
	diazinon + captan	Agrox B-2	340 g	Available as 2 kg container and will treat 600 kg of corn seed. Do not use on seed already treated with an insecticide. Seed within one month of treatment.
		Agrox CD	200 g	Available as a 600 g container and will treat 300 kg of corn seed. Use this product only on seed previously treated with captan or thiram.
Soil Applied at Planting Only			**per 100 m (328 ft) row**	
In-furrow application is safer to the applicator and non target animals then T-band application.	tefluthrin	Force 3 G	37.5 g	In-furrow only. Place directly in the seed furrow behind the planter disc openers.
	terbufos	Counter 15 G	75 g	Lock and load. May be applied in a T-band or in-furrow. For banded applications, place directly over the furrow in a 15 cm band ahead of the press wheel. In-furrow application, place all material directly in the open seed furrow, behind the planter disc openers.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SEEDCORN BEETLE				
Risk factors: no-till, cool, backwards spring, slow emergence conditions.				No registered products available at this time.
BLACK CUTWORM				
Soil Applied at Planting Only			**per 100 m (328 ft) row**	
Risk factors: winter annual weeds and volunteer wheat before planting, no-till, heavy soybean residue.	tefluthrin	Force 3 G	37.5 g	Soil applied control is not as good as a well timed rescue treatment. May be applied as a banded or in-furrow application. For banded applications, place directly in a 15 cm band ahead of the press wheel. In-furrow application, place all material directly in the open seed furrow, behind the planter disc openers.
		Transgenic Bt corn hybrids	See Table 1–6 for Bt corn options	Herculex varieties only. May only control young larvae.
Rescue Treatments			**per ha (per ac)**	
Scout early! Cutworms are easier to control when small. Look for leaf feeding (pinholes) by young climbing larvae as first sign of damage. If more than 10% of plants show leaf feeding, treating at this time will give nearly 100% control.	permethrin	Pounce EC	175–390 mL (70–156 mL)	Seedling stage only. Apply under warm, moist conditions in evening or night when cutworms are most active. Do not disturb soil for 5 days after application.
	cypermethrin	Ripcord 400 EC	175 mL (70 mL)	Seedling stage only. Apply under warm, moist conditions in evening or night when cutworms are most active. Do not disturb soil for 5 days after application. 21 days to harvest.
	chlorpyrifos	Lorsban 4E	1.2–2.4 L (480–960 mL)	Seedling stage only. 70 days to harvest.
		Pyrinex 480 EC	1.2–2.4 L (480–960 mL)	Seedling stage only. Apply once per season. 7 days to harvest.
	cyhalothrin-lambda	Matador 120 EC	83 mL (34 mL)	Seedling stage only. Ground or aerial application. Apply under warm, moist conditions in evening or night when cutworms are most active. Do not disturb soil for 5 days after application. 3 applications/season, 2 may be by air. 14 days to harvest.
EUROPEAN CHAFER (WHITE GRUB)				
Avoid planting corn if grub population is extreme — plant soybeans instead. No thresholds available at this time.				No registered products available at this time.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
EUROPEAN CORN BORER				
To manage potential corn borer resistance, plant a minimum of 20% of your total acreage with non-Bt corn hybrids and position so that this refuge is no more than 400 m from any Bt corn. Do not apply ECB insecticide to non Bt refuge. For more information regarding Bt corn and/or refuge options, see *A Grower's Handbook; Controlling European corn borer with Bt corn technology* found at www.cornpest.ca.		Transgenic Bt corn hybrids	See Table 1–6 for Bt corn options	Insecticides have generally not provided economic control of ECB in field corn. Using Bt transgenic corn provides much better control. Use corn hybrids that express the Bt toxin in the ear as well as the stalk to help avoid stalk and ear rot. Keep careful and accurate records as to where Bt and non-Bt hybrids are planted.
			per ha (per ac)	
Seed corn only See OMAF Publication 811, *Agronomy Guide for Field Crops*, to calculate economic thresholds.	deltamethrin	Decis 5.0 EC	250–300 mL (100–120 mL)	Ground or aerial application. Apply when egg masses begin to hatch but no later than when 1st pinhole feeding occurs on foliage. For 2nd brood in late planting, apply before tassels show. Repeat in 5–8 day intervals. Maximum 3 applications/yr. Do not feed silage or stubble to dairy cattle.
	cypermethrin	Cymbush 250 EC Ripcord 400 EC	175 mL (70 mL) 175 mL (70 mL)	Apply when egg masses begin to hatch but no later than when 1st feeding occurs on foliage. For 2nd brood in late planting, apply before tassels show. Use a minimum 300–500 L water/ha for ground application and 11–22 L/ha for aerial application. Re-entry period when foliage dries. Maximum 3 applications/yr. Up to 2 applications/ season by air. 5 days to harvest.
	cyhalothrin-lambda	Matador 120 E	83 mL (34 mL)	Ground or aerial application. Spray no later than 1st appearance of feeding. Spray no later than 14 days before silage harvest. No more than 3 applications per season, 2 may be by air.
	Bacillus thuringiensis	Dipel 2X DF	0.56–1.12 kg (0.22 –0.45 kg)	Good option for organically grown corn. Apply when pinhole feeding is observed in at least 5% of the plants. Repeat at 7 day intervals. Only effective against small larvae and must be applied before larvae begin stalk boring.
	carbaryl	Sevin XLR Plus	2.5–4.0 L (1.0–1.6 L)	For larvae in whorls and foliage, treat entire plant. Repeat as necessary. For silks and ears, apply in 2–4 day intervals when silks first appear. 1 day to harvest. Follow precautions applying to honeybees.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
ARMYWORM (TRUE AND FALL)				
			per ha (per ac)	
Five to 6 larvae in an area 30 x 30 cm warrant chemical control. Treat if larvae < 2.0 cm long and threshold has been exceeded. If larvae have white eggs attached to them they are parasitized and may not need treatment.	trichlorfon	Dylox 420	1.5–2.75 L (600–1100 mL)	Ground application only. No more than 3 applications per season.
	carbaryl	Sevin XLR Plus	2.5–4.0 L (1.0–1.6 L)	For larvae in whorls and foliage, treat entire plant. Repeat as necessary. For silks and ears, apply in 2–4 day intervals. 1 day to harvest. Follow precautions regarding honeybees.
	cyhalothrin-lambda	Matador 120 E	83 mL (34 mL)	Ground or aerial application. Spray no later than 1st appearance of feeding. Spray no later than 14 days before silage harvest. No more than 3 applications per season, 2 may be by air.
CORN EARWORM				
Insecticides have generally not provided economic control of CEW in field corn. There may be some value in treating seed corn to maintain kernel quality.	cyhalothrin-lambda	Matador 120 E	83 mL (34 mL)	Spray no later than 1st appearance of feeding. Spray no later than 14 days before silage harvest. No more than 3 applications per season, 2 may be by air.
	cypermethrin	Cymbush 250 EC Ripcord 400 EC	175 mL (70 mL) 175 mL (70 mL)	Ground or aerial application. Ensure good coverage of ears and silks. Use minimum 300–500 L/ha of water for ground application and 11–22 L/ha for aerial application. 5 days to harvest. Maximum of 3 applications per year, 2 may be by air.
FLEA BEETLES				
Seed Treatment			**per 100 kg seed**	
Flea beetles are a vector of Stewart's bacterial wilt. It is uneconomical to spray corn with insecticides to protect against Stewart's wilt except in seed corn with highly susceptible inbreds.	imidacloprid	Gaucho 480 FL	520 mL	For seed corn only. Ensure good coverage. For use in commercial seed treaters only.
POTATO STEM BORER				
No insecticides are recommended or registered.				
CORN LEAF APHID				
			per ha (per ac)	
Aphids are rarely a problem in corn in Ontario. Spray only if populations exceed 400 aphids per plant on average.	endosulfan	Thiodan 4 EC Thionex EC	2.75 L (1.1 L) 2.75 L (1.1 L)	Ground application only. No more than 2 applications per season. 50 days to harvest.
SAP BEETLES				
Not an economic pest but can carry Fusarium. Chemical control is not recommended.				
SLUGS				
Usually not an economic pest because growing point is not affected. Chemical control is not recommended.				

TABLE 2–2. Corn (Field and Seed) Seed and Soil Applied Fungicide Recommendations

Active Ingredients	Product	Formulation	Corn Diseases				
			Fusarium Seedling Blight	Rhizoctonia Damping-off	Pythium Damping-off	Aspergillus Seed Rot	Penicillium Seed Rot
INSECT AND DISEASE CONTROL							
Untreated Seed							
diazinon + captan	Agrox B–2	P (DB)	+	—	—	+	+
diazinon + lindane + captan	Agrox B-3	P (DB)	+	—	—	+	+
Seed Pretreated With Fungicide							
diazinon + captan	Agrox CD	P (DB)	For insect control only. Disease control via fungicide pretreatment.				
diazinon + lindane + captan	Agrox D-L Plus	P (DB)					
diazinon + lindane + captan	DL+C	P (DB)					
DISEASE CONTROL							
captan	Captan Flowable	F	+	—	—	+	+
carbathiin + thiram	Vitaflo-280	F	+	+	—	—	—
fludioxonil	Maxim 480 FS	F	+	+	—	+	+
metalaxyl	Allegiance FL	F	—	—	+	—	—
metalaxyl	Apron FL	F	—	—	+	—	—
metalaxyl-M	Apron XL	LS	—	—	+	—	—

DB = Drill Box Application F= Flowable LS = Liquid Suspension P= Powder

+ = Recommended for disease listed — = NOT recommended

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions etc.)
SEED ROTS AND SEEDLING BLIGHTS				
It is recommended that all seed corn be treated with a fungicide seed treatment to prevent early season preemergence and postemergent damping-off problems. This will help reduce seed decay and seedling blights. Corn seedling diseases are prevalent under cool wet conditions that keep the soil temperatures below 13°C (55°F). Low-lying or poorly drained areas of the field are often the first to show disease problems. Seed rots and seedling blights are more severe in no-till or reduced tillage fields since heavy residue will keep soil temperatures cooler and wetter longer than conventional fields. Damping-off will occur in conventional fields when the crop is planted early into conditions that favour disease development or when environmental conditions cause the corn seed to sit in the ground for a prolonged period of time. Other factors that delay germination and emergence such as compaction, crusting, deep planting, etc. can also result in a poor stand. Plant vigour is often reduced in those plants that do survive.				
DAMPING-OFF *PYTHIUM*				
Seed Treatment			**per 100 kg seed**	
Can occur on all soil types but losses are greatest in cold, wet, clay soils. Minimize soil compaction and remove excess moisture through increased drainage. Plant when soil temperatures above 13°C (55°F). Treat seed with metalaxyl or metalaxyl-M. No known resistance but some degree of tolerance available in hybrids. Rotation has limited effect.	metalaxyl-M	Apron XL LS	20–40 mL	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting. Read label for information regarding resistant strains of fungus.
	metalaxyl	Allegiance FL Apron FL	46–110 mL 46–110 mL	Do not graze or feed livestock on seeded area for 4 weeks after planting.
RHIZOCTONIA				
Seed Treatment				
Can occur on all soil types. No known resistance. Remove excess moisture. Plant when soil temperatures are above 13°C (55°F).	fludioxonil	Maxim 480 FS	5.2–10.4 mL	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting. 30 days to harvest.
	carbathiin + thiram	Vitaflo 280	280 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
FUSARIUM SEEDLING BLIGHT				
Seed Treatment				
Some level of resistance or tolerance available in hybrids. Rotate with other crops. Tillage has little affect. Treat seed with fungicide and reduce early season stresses. Plant when soil temperatures are above 13°C (55°F).	fludioxonil	Maxim 480 FS	5.2–10.4 mL	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting. 30 days to harvest.
	carbathiin + thiram	Vitaflo 280	280 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	captan	Captan Flowable	200 mL	Mix with the amount of water required for the slurry treater equipment to be used.
ASPERGILLUS AND PENICILLUM SEED ROT				
Seed Treatment	fludioxonil	Maxim 480 FS	5.2–10.4 mL	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting. 30 days to harvest.
Penicillium seedling blight favours high temperatures and is found only until the nodal roots develop. Infected roots may appear blue-green. Aspergillus seed rot is not generally a problem in Ontario.				

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions etc.)
RUST				
			per ha (per ac)	
Rust is generally not a problem in Ontario except when infection begins early in the season. Field corn has good resistance when compared to seed corn, sweet corn and specialty corn hybrids. Foliar fungicides in field corn are not needed unless disease appears before corn tassels. Humid, cool conditions favour the disease.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply when rust pustules 1st appear. Can be tank mixed with Ripcord insecticide for insect and disease control. Under severe disease pressure a second application 14 days later may be necessary. 14 days to harvest.
	azoxystrobin	Quadris	453 mL (183 mL)	**Seed corn only**. Ground application only. Apply prior to disease development. Second application may be made 7–14 days later. Maximum 2 applications per season. 7 days to harvest.
NORTHERN CORN LEAF BLIGHT				
Not generally a problem in Ontario since good resistance available. Crop rotation and tillage will reduce inoculum levels in surface residues. In reduced tillage systems, rotation and resistance are necessary. Chemical control not usually economical in field corn.				
HELMINTHOSPORIUM LEAF SPOT				
Not generally a problem in Ontario since resistance hybrids available. Crop rotation and tillage will reduce inoculum levels in surface residues. In reduced tillage systems, rotation and resistance are necessary. Chemical control not usually economical in field corn.				
EYE SPOT				
			per ha (per ac)	
Resistant varieties available. Crop rotation and tillage will reduce inoculum levels in surface residues. In reduced tillage systems, rotation and resistance are necessary. Chemical control not usually economical in field corn.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply when disease first appears. Can be tank mixed with Ripcord insecticide for insect and disease control. 14 days to harvest.
GRAY LEAF SPOT				
Some hybrids are tolerant to the disease. Crop rotation and tillage will reduce inoculum levels in surface residues. In reduced tillage systems, rotation and resistance are necessary. Chemical control not usually economical in field corn.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply when disease first appears. Can be tank mixed with Ripcord insecticide for insect and disease control. 14 days to harvest.

3. Soybeans

INSECTS

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SEEDCORN MAGGOT				
Seed Treatment			**per 100 kg seed**	
Consider insecticide seed treatments in early planted fields where large amounts of manure, green manure or residue have been recently incorporated or fields are freshly tilled and when cool backward emergence conditions are expected.	diazinon + lindane + captan			For all seed treatments use full rate and ensure good coverage of seed.
		Agrox B-3	340 g	Available as 2 kg container and will treat 625 kg of soybean seed. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
		Agrox D-L Plus	200 g	Available as a 600 g container and will treat 300 kg of soybean seed. Use this product only on seed previously treated with captan or thiram. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
		DL + C	200 g	Use this product only on seed previously treated with captan or thiram. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
	diazinon + captan			For all seed treatments use full rate and ensure good coverage of seed.
		Agrox B-2	340 g	Available as 2 kg container and will treat 625 kg of soybean seed. Do not use on seed already treated with an insecticide. Seed within one month of treatment.
		Agrox CD	200 g	Available as a 600 g container and will treat 300 kg of soybean seed. Use this product only on seed previously treated with captan or thiram.
SLUG				
No chemical control available. Slugs often avoid contact by feeding below ground and rainfall easily washes the material from the leaves. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for rotation and tillage recommendations.				

INSECTS

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SOYBEAN APHID				
			per ha (per ac)	
Aphid infestations are more likely to cause yield reduction if the plants are already suffering from drought conditions or another stress factor. Refer to the OMAF Web site at www.gov.on.ca/OMAF/english/ crops/field/soybeans for more information on thresholds and management options.	dimethoate	Cygon 480	1 L (400 mL)	Use high volume, high pressure and ensure good coverage. Do not feed or allow livestock to graze on treated forage. Do not apply within 30 days of harvest.
TWO-SPOTTED SPIDER MITES				
Scout fields around the first week of July. Infestations usually move in from edge of field as hot spots. Spot spray when populations average 4 mites per leaf.	dimethoate	Cygon 4 E Lagon 480 EC	1 L (400 mL) 1 L (400 mL)	Do not feed or allow livestock to graze treated forage. No more than two applications per season. 7 days to harvest.
POTATO LEAFHOPPER				
Potato leafhoppers are controlled in soybeans by plant resistance via leaf pubescence. Problems are rare in soybeans in Ontario.				No registered products available at this time.
BEAN LEAF BEETLE				
This insect vectors Bean Pod Mottle Virus. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for sampling methods and management options.				No registered products available at this time.

TABLE 3–1. Soybean Seed and Soil Applied Fungicide Recommendations

Active Ingredients	Product	Formulation	Soybean Diseases				
			Phytophthora	Pythium Damping Off	Phomopsis Seed Mould	Rhizoctonia Damping Off	Fusarium Seedling Blight
INSECT AND DISEASE CONTROL							
Untreated Seed							
diazinon + captan	Agrox B-2	P (DB)	—	—	+	—	+
diazinon + lindane + captan	Agrox B-3	P (DB)	—	—	+	—	+
Seed Pretreated With Fungicide							
diazinon + captan	Agrox CD	P (DB)	For insect control only. Disease control via fungicide pretreatment.				
diazinon + lindane + captan	Agrox D-L Plus	P (DB)					
diazinon + lindane + captan	D.L.+C.	P (DB)					
DISEASE CONTROL							
captan	Captan	F	—	—	+	—	+
carbathiin + thiram	Anchor	F (DB)	—	—	+	+	+
carbathiin + thiram	Vitaflo-280	F	—	—	+	+	+
fludioxonil	Maxim 480 FS	F	—	—	+	+	+
metalaxyl	Allegiance FL	F	+	+	—	—	—
metalaxyl	Apron FL	F	+	+	—	—	—
metalaxyl-M	Apron XL	LS	+	+	—	—	—

DB = Drill Box Application F = Flowable P = Powder LS = Liquid Suspension
+ = Recommended for disease listed — = NOT recommended

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SOYBEAN CYST NEMATODE				
SCN is often confused with other common problems such as nutrient deficiencies, herbicide injury, soil compaction, drought, flooding or root rots. By the time above ground symptoms from SCN feeding become noticeable, most fields have lost 25%–30% yield potential to the nematode. Early detection through scouting and soil testing is critical. If you suspect SCN, plants should be carefully dug (not pulled) and soil gently removed from the roots. Cysts are white to yellow and about the size of a pin-head. Rotating non-host crops such as corn, wheat, alfalfa, clover or vegetable crops such as tomatoes, with resistant varieties, will lower SCN populations and improve yields on SCN infested fields.				
PHYTOPHTHORA ROOT ROT				
Seed Treatment			**per 100 kg seed**	
Select soybean varieties that have both specific resistance (Rps genes such as 1K and 1C) and good partial resistance (tolerance) to all races of Phytophthora. Consult with your seed company for variety profiles. Primarily controlled through resistant varieties. Losses greatest in cold, wet, clay soils. Minimize soil compaction and remove excess moisture through increased drainage. A small amount of tillage will help warm soil and increase surface drainage. Rotate with corn and wheat. Plant when soil temperatures above 13°C (55°F). Treat seed with metalaxyl or metalaxyl-M (higher rate).	metalaxyl-M	Apron XL-LS	40 mL	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or feed livestock on seeded area for 4 weeks after planting. Read label for information regarding resistant strains of fungus.
	metalaxyl	Allegiance FL Apron FL	46–93 mL 46–93 mL	Do not graze or feed livestock on seeded area for 4 weeks after planting.
PHOMOPSIS SEED MOULD				
Seed Treatment				
Most severe when cool, wet conditions delay harvest. Some varieties more susceptible than others. Fungicide seed treatments will improve the germination of low to moderately infected seed. Do not plant severely infected seed. Plant good quality seed with a germination rate of at least 80%–90%. Rotate with non host crops such as corn and wheat, remove excess surface residue and harvest as early as possible.	carbathiin + thiram	Anchor	600 mL	Drill box application. Ensure uniform coverage on seed. Do not apply Anchor through commercial seed treating equipment or through an auger as excessive seed wetness may result. Do not graze or feed livestock on treated areas for 4 weeks after planting.
		Vitaflo 280	260 mL	Do not store treated soybean seed. May be applied through commercial seed treatment equipment or auger. Ensure uniform coverage.
	captan	Captan Flowable	280 mL	Mix with the amount of water required for the slurry treater equipment to be used.
RHIZOCTONIA DAMPING OFF				
Seed Treatment				
Can occur on all soil types and environmental conditions. Disease losses greatest when a dry spring is followed by wet conditions. Few management options exist since no resistant or tolerant varieties available. Seed treatment and crop rotation with corn and small grains can help minimize the disease.	fludioxonil	Maxim 480 FS	5.2–10.4 mL	For commercial application only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting.
	carbathiin + thiram	Anchor	600 mL	Drill box application. Ensure uniform coverage on seed. Do not apply Anchor through commercial seed treating equipment or through an auger as excessive seed wetness may result. Do not graze or feed livestock on treated areas for 4 weeks after planting.
		Vitaflo 280	260 mL	Do not store treated soybean seed. May be applied through commercial seed treatment equipment or auger. Ensure uniform coverage.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
PYTHIUM DAMPING OFF				
Seed Treatment			**per 100 kg seed**	
Can occur on all soil types but losses are greatest in cold, wet, clay soils. Minimize soil compaction and remove excess moisture through increased drainage. Plant when soil temperatures above 13°C (55°F). Treat seed with metalaxyl or metalaxyl-M. No known resistance but some degree of tolerance available in cultivars. Rotation has limited affect. Pythium control less affected by rate.	metalaxyl-M	Apron XL LS	20–40 mL	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or feed livestock on seeded area for 4 weeks after planting. Read label for information regarding resistant strains of fungus.
	metalaxyl	Allegiance FL Apron FL	46–93 mL 46–93 mL	Do not graze or feed livestock on seeded area for 4 weeks after planting.
FUSARIUM SEEDLING BLIGHT				
Seed Treatment				
Cool, wet spring conditions favour infection. Resistant varieties not available. Minimize soil compaction and remove excess moisture through increased drainage. A small amount of tillage will help warm soil and increase surface drainage. Rotate with corn and wheat. Plant high quality seed when soil temperatures are above 13°C (55°F). Fungicide seed treatment recommended. Mounding or ridging soil at the base of the plants produce adventitious roots that can minimize losses.	fludioxynil	Maxim 480 FS	5.2–10.4 mL	For commercial application only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting.
	carbathiin + thiram	Anchor	600 mL	Drill box application. Ensure uniform coverage on seed. Do not apply Anchor through commercial seed treating equipment or through an auger as excessive seed wetness may result. Do not graze or feed livestock on treated areas for 4 weeks after planting.
		Vitaflo 280	260 mL	Do not store treated soybean seed. May be applied through commercial seed treatment equipment or auger. Ensure uniform coverage.
	diazinon + captan	Agrox B-2	320 g	Available as a 2 kg container and will treat 625 kg of soybean seed. Use full rate and ensure good coverage of seed. Seed within one month of treatment. Do not use on seed already treated with an insecticide.
	diazinon + lindane + captan	Agrox B-3	320 g	Available as a 2 kg container and will treat 625 kg of soybean seed. Use full rate and ensure good coverage of seed. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
	captan	Captan Flowable	280 mL	Mix with the amount of water required for the slurry treater equipment to be used.

INSECTS

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
ALFALFA SNOUT BEETLE				
No chemical control available. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for management information.				
ALFALFA WEEVIL				
			per ha (per ac)	
First Cut: If 40% of the stems have feeding damage in the tips, cut and remove from fields as soon as possible. If this level of damage occurs a week or more before optimum cutting time, then spray may be necessary.	phosmet	Imidan 50 WP	2.25 kg (900 g)	Alfalfa only. Ground application only. Do not apply during bloom. Only 1 application per cutting. 7 days to cutting or grazing.
Second Cut: If damage was serious on first cut, feeding may continue and early re-growth should be carefully checked.	cyhalothrin-lambda	Matador 120 E	83 mL (34 mL)	Alfalfa only. Ground or aerial application. Apply when larvae are small and populations are high. Maximum of 3 applications per year, 1 may be by air. 14 days to cutting or grazing. 24 hr. re-entry period. Do not graze or feed lactating dairy animals on treated forage.
Natural enemies are generally highly effective at controlling this pest. For the safety of these natural enemies, chemical control is not recommended unless pest population exceeds the action threshold. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more information on action thresholds.	azinphos-methyl	Guthion Solupak 50 WP	1.12–1.75 kg (0.45–0.7 kg)	Alfalfa and clover only. Use a minimum of 80 L of water/ha for ground application and 40 L/ha for aerial application. 21 days to harvest. Minimum re-entry period of 48 hr. Only 1 application per cutting. Back pack and hand-wand spraying prohibited.
		Guthion 240 SC	2.25–3.5 L (0.9–1.4 L)	
		Sniper	1.12–1.75 kg (0.45–0.7 kg)	

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
POTATO LEAFHOPPERS				
			per ha (per ac)	
Leafhoppers are most severe in new seedings and in regrowth under hot dry weather. Some resistant varieties having glandular hairs on the leaves and stems have been found to be effective. Use chemical control only if leafhoppers exceed the threshold, as insecticides will also kill effective natural enemies of alfalfa weevil. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for threshold charts.	dimethoate	Cygon 480 E Lagon 480 EC	425 mL (170 mL) 425 mL (170 mL)	Alfalfa, forage and pasture. Ground and aerial application. Do not apply during bloom. 2 days to harvest and grazing. No more than 2 applications per season.
	cyhalothrin-lambda	Matador 120 E	83 mL (34 mL)	Alfalfa only. Ground or aerial application. Apply when larvae are small and populations are high. Maximum of 3 applications/year, 1 may be by air. 14 days to cutting or grazing. 24-hour re-entry period. Do not graze or feed lactating dairy animals on treated forage.
	azinphos-methyl	Guthion Solupak 50 WP Guthion 240 SC Sniper	1.12–1.75 kg (0.45–0.7 kg) 2.25–3.5 L (0.9–1.4 L) 1.12–1.75 kg (0.45–0.7 kg)	Alfalfa and clover only. Use a minimum of 80 L of water/ha for ground application and 40 L/ha for aerial application. 21 days to harvest. Minimum re-entry period of 48 hr. Only 1 application per cutting. Back pack and hand-wand spraying prohibited.
EUROPEAN SKIPPER				
If 6 to 8 caterpillars in a 30 cm x 30 cm area are found as early as the brown headed stage, treat the field or the infested area. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for proper scouting procedures.	*Bacillus thuringiensis* (Bt)	Dipel 2X DF Thuricide HPC	140–275 g (60–115 g) 2.25 L (900 mL)	Timothy only. 0 days to cutting or grazing. 0 days to cutting or grazing.
GRASSHOPPERS				
Begin scouting in late June when grasshoppers are still young. Spraying insecticides on alfalfa will also kill the natural enemies of alfalfa weevil and lygus bugs.	malathion	Malathion 500 EC	2.25–2.75 L (0.9–1.1 L)	For alfalfa and clover. Do not apply during bloom. Apply when 75% of foliage shows feeding damage. Less effective below 20°C (68°F). 7 days to cutting or grazing.
	cyhalothrin-lambda	Matador 120 E	63–83 mL (26–34 mL)	Alfalfa only. Ground or aerial application. Apply when larvae are small and populations are high. Maximum of 3 applications/year, 1 may be by air. 14 days to cutting or grazing. 24-hour re-entry period. Do not graze or feed lactating dairy animals on treated forage.
	azinphos-methyl	Guthion Solupak 50 WP Guthion 240 SC Sniper	525–850 g (210–340 g) 1.1–1.75 L (440–700 mL) 525–850 g (210–340 g)	Alfalfa and clover only. Use a minimum of 80 L of water/ha for ground application and 40 L/ha for aerial application. Minimum re-entry period of 48 hr. Only 1 application per cutting. Back pack and hand-wand spraying prohibited. 21 days to harvest.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
ALFALFA BLOTCH LEAFMINER				
			per ha (per ac)	
Natural enemies are highly effective at controlling this pest. For the safety of these natural enemies, chemical control is not recommended unless pest population exceeds the action threshold. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more information.	dimethoate	Cygon 480 E Lagon 480 E	550 mL (220 mL) 550 mL (220 mL)	Alfalfa only. Ground and aerial application. Do not apply during bloom. Use at least 200 L/ha of water for ground application. No more than 2 applications/season. 2 days to cutting or grazing.
	phosmet	Imidan 50 WP	2.25 kg (900 g)	Alfalfa only. Do not apply during bloom. Spray when first signs of infestation are visible. 7 days to cutting or grazing.
ARMYWORM (TRUE AND FALL)				
Five to 6 larvae in an area 30 x 30 cm warrant chemical control. Treat if larvae < 2.0 cm long and threshold has been exceeded. If larvae have white eggs attached to them they are parasitized and may not need treatment.	carbaryl	Sevin XLR Plus	2.5–5.25 L (1.0–2.1 L)	Alfalfa, clover and forage grasses. 2 days to harvest.

DISEASES

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SEED AND ROOT ROTS				
PHYTOPHTHORA ROOT ROT				
Seed Treatment			**per 100 kg seed**	
Plant resistant varieties that are treated with metalaxyl or metalaxyl-M. Drain excess moisture and avoid compaction. Avoid stresses such as insects, weeds and untimely cuttings that may stress the plants and make them more susceptible to Phytophthora. Do not cut during wet conditions. Crop rotation has little affect on the disease. Promote lateral root growth with good fertility program.	metalaxyl-M	Apron XL LS	40 mL	For alfalfa, clover, and forage grasses. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or feed livestock on seeded area for 4 weeks after planting. Read label for information regarding resistant strains of fungus.
	metalaxyl	Allegiance FL Apron FL	46–110 mL 46–110 mL	Do not graze or feed livestock on seeded area for 4 weeks after planting.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
PYTHIUM DAMPING OFF				
Seed Treatment			**per 100 kg seed**	
Fungicide seed treatment. Drain excess moisture and avoid compaction. Plant when soil and weather conditions favour rapid emergence and early growth of seedlings. Increase plant populations to compensate for any plant losses.	metalaxyl-M	Apron XL LS	20–40 mL 40 mL	Use 20–40 mL for forage grasses. Use 40 mL for alfalfa, clover, trefoil and vetch. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or feed livestock on seeded area for 4 weeks after planting. Read label for information regarding resistant strains of fungus.
	metalaxyl	Allegiance FL Apron FL	46–110 mL 46–110 mL	Do not graze or feed livestock on seeded area for 4 weeks after planting.
FOLIAR AND STEM DISEASES				
VERTICILLIUM WILT				
Seed Treatment				
Resistant or highly resistant varieties best means of control. The fungus is spread primarily on the cutting bar of forage harvesting equipment. Before harvesting, clean the cutting bar with a 1% solution of bleach followed by a clean water rinse and oil spray. Cut the youngest fields first, working towards the oldest fields. Wait 2–3 years between alfalfa crops. Maintain a good weed control program since some weeds can be alternate hosts.	thiram	Thiram 75WP	360 g	Alfalfa only. Do not graze treated areas or feed clipping from treated areas to livestock.
WHITE MOULD				
Foliar Treatment			**per ha (per ac)**	
Some differences in susceptibility between cultivars exist. Fields established under minimum tillage may have more disease. Spring planting may reduce incidence.	benomyl	Benlate Benlate Toss-N-Go	1.5 kg (600 g)	For alfalfa seed production only. Apply at early bloom through to full bloom. Do not make more than 2 applications per year. Do not graze or feed treated hay to livestock.
LEAF SPOT AND STEM SPOT				
Foliar Treatment				
Timely harvesting of forages is important to reduce leaf loss and minimize disease in the regrowth. There are no practical control strategies available for leaf spot diseases in forages. Leaf spots can reduce the protein level in legume leaves, so it is important to balance the time of harvest between the optimum stage for highest protein (bud stage in alfalfa) and the level of leaf spot disease.	mancozeb	Dithane DG Rainshield NT	1.46 kg (584 g)	For seed production only. Apply prior to 50% bloom. Maximum of 3 applications per year. Repeat 7–10 days after first application and 10 days after second application. Do not graze treated crop or cut for hay.

5. Cereals

INSECTS

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
WHEAT, BARLEY, OATS and RYE				
WIREWORMS				
Seed Treatment			**per 100 kg seed**	
See OMAF Publication 811, *Agronomy Guide for Field Crops*, for sampling methods.	carbathiin + thiram + lindane	Vitaflo Dual Purpose	260 mL (wheat) 325 mL (barley)	Drill box or commercial application. Do not graze or feed livestock on treated areas for 4 weeks after planting. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
EUROPEAN CHAFER (WHITE GRUB)				
These grubs can follow soybean crops on sandy soils. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more details.				No registered products available at this time.
ARMYWORM (TRUE AND FALL)				
			per ha (per ac)	
Five to 6 larvae in an area 30 x 30 cm warrant chemical control. Treat if larvae < 2.0 cm long and threshold has been exceeded. If larvae have white eggs attached to them, they are parasitized and may not need treatment.	trichlorfon	Dylox 420 LC	1.5 L (0.6 L)	Ground application only. Wheat, barley and oats. 21 days to harvest
	carbaryl	Sevin XLR Plus	2.5–5.25 L (1.0–2.1 L)	14 days to harvest for wheat, rye and oats. 28 days to harvest for barley. See precautions applying to honeybees.
	methomyl	Lannate Toss-N-Go	270–540 g (108– 216 g)	Ground and aerial application. 20 days to harvest. Minimum period before re-entry is 24 hr.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
CEREAL LEAF BEETLE				
			per ha (per ac)	
Natural enemies are highly effective at controlling this pest. For the safety of these natural enemies, chemical control is not recommended unless pest population exceeds the action threshold of 1 larvae per stem. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more information.	malathion	Malathion 500 EC	2.2 L (880 mL)	7 days to harvest. Less effective below 20°C (68°F).
	azinphos-methyl	Guthion Solupak 50 WP	0.85–1.12 kg (0.34–0.45 kg)	For rye only. Use minimum of 80 L of water/ha for ground and 40 L/ha for aerial application. Apply only once per season. Do not harvest for food, feed or forage within 30 days of treatment. Minimum re-entry period is 48 hr.
		Guthion 240 SC	1.75–2.25 L (700–900 mL)	
		Sniper	0.85–1.12 kg (0.34–0.45 kg)	
GRASSHOPPERS				
More abundant in drier years. If populations are high enough, wheat heads may be clipped. Seedling winter wheat is also at risk. Infestations usually begin along field borders. Early season weed control can help eliminate food source for early season nymphs, however, late season weed control in and around the field will actually cause this insect to migrate from the weeds onto the crop and cause damage. If populations are high, spot spray in border areas that are infested before migration into the field occurs.	malathion	Malathion 500 EC	2.25–2.75 L (900–1100 mL)	7 days to harvest. Less effective below 20°C (68°F).
	cypermethrin	Ripcord 400 EC	50–70 mL (20–28 mL)	Ground and aerial application. Use lower rates for small grasshoppers and when soil temperatures are cool (15–20°C). Avoid spraying when temperatures are above 25°C. Repeat treatment as necessary. Do not graze treated crop or cut for hay. 60 days to harvest.
	cyhalothrin-lambda	Matador 120 E	63–83 mL (26–34 mL)	Ground or aerial application. Apply the low rate when grasshoppers are up to the 3rd nymphal stage (up to 1 cm in length) or when insect numbers are low. Apply the high rate when grasshoppers are larger, up to but not including winged adults (up to 2.5 cm in length) or when insect numbers are high. 3 applications/yr., 2 may be by air. 14 day interval from application to harvest or foraging. Do not graze or feed lactating dairy animals on treated green cereal forage or treated pasture. In wheat, do not apply within 28 days of harvest or 14 days of livestock foraging. In barley and oats do not apply within 28 days of harvest or 14 days of livestock foraging.
	carbaryl	Sevin XLR Plus	1.25–2.5 L (0.5–1.0 L)	14 days to harvest for wheat, rye and oats. 28 days to harvest for barley. See precautions applying to honeybees.
	azinphos-methyl	Guthion Solupak 50 WP	525–850 g (210–340 g)	For rye only. Use minimum of 80 L of water/ha for ground and 40 L/ha for aerial application. Apply only once per season. Do not harvest for food, feed or forage within 30 days of treatment. Minimum re-entry period is 48 hr.
		Guthion 240 SC	1.1–1.75 L (440–700 mL)	
		Sniper	525–850 g (210–340 g)	

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
GROWTH REGULATORS FOR LODGING REDUCTION IN CEREALS				
			per ha (per ac)	
Refer to variety factsheets for lodging scores. High risk factors include fields with a history of manure applications and legume hay.	ethephon	Ethrel	*Spring Barley* 1.0–1.5 L (0.4–0.6 L) 2-row cultivar 1.0–2.0 L (0.4–0.8 L) 6-row cultivar *Spring Wheat* 1.0–1.5 L (0.4–0.6 L) *Winter Wheat* 1.25–2.5 L (0.5–1.0 L)	Ground and aerial application. Correct timing is critical. Use lower rate unless lodging conditions are expected to be severe. Apply when most of the tillers are between early flag leaf emergence to swollen boot stage (Zadoks 37 to 45). Do not apply after more than 10% of the awns have emerged (Zadoks 49). Use higher rates on crops that are heavily fertilized (more than 100 kg/ha of total available nitrogen) and have ample moisture (more than 25 cm of precipitation) and are prone to lodging. Do not apply within 35 days of harvest.

TABLE 5–1. Wheat Seed and Soil Applied Fungicide Recommendations

Active Ingredient	Products	Formulation	Wheat Diseases: Seed-Borne: Loose Smut	Seed-Borne: Seed-borne Septoria	Seed-Borne: Seed-borne Fusarium	Seed-Borne: Seed-borne Dwarf Bunt	Soil-Borne: Soil-borne Dwarf Bunt	Soil-Borne: Common Bunt	Soil-Borne: Common Root Rot	Soil-Borne: Take All	Soil-Borne: Pythium Damping Off	Soil-Borne: Soil-borne Fusarium	Early Season: Powdery Mildew	Early Season: Septoria
INSECT AND DISEASE CONTROL														
Seed Treatments with Insecticides														
carbathiin + thiram + lindane	Vitavax Dual Purpose	F	+	—	+	+	—	+	+	—	—	+	—	—
DISEASE CONTROL														
carbathiin + thiram	Vitaflo-280	F	+	—	+	+	—	+	+	—	—	+	—	—
difenoconazole + metalaxyl-M	Dividend XL	F	+	+	+	+	+	+	+[1]	+[1]	+	+	—	+[2]
difenoconazole + metalaxyl-M	Dividend XL RTA	F	+	+	+	+	+	+	+[1]	+[1]	+	+	—	+[2]
metalaxyl-M	Apron XL	F	—	—	—	—	—	—	—	—	+	—	—	—
tebuconazole	Raxil FL	F	+	—	+	—	—	+	+[1]	—	—	+	—	—
triadimenol	Baytan 30	F	+	—	—	—	—	+	—	+[1]	—	—	+	—

DB= Drill Box Application EC = Emulsifiable Concentrate F= Flowable P= Powder

+ = Recommended for disease listed — = Not Recommended [1] Suppression only [2] Winter wheat only

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
WHEAT				
SEED ROTS AND SEED-BORNE				
Use good quality, clean seed. All wheat seed needs to have a fungicide seed treatment applied to control soil-borne and seed-borne diseases such as seed rots and seedling blights, seed-borne Septoria, seed-borne Fusarium seedling blight, seed borne dwarf bunt, common bunt and loose smut. The best protection against seedling blights, smut and the bunts can be achieved through the use of a seed treatment that contains a combination of fungicides since no one fungicide is affective against all these diseases. Good coverage of the seed is essential since their performance will be reduced.				
SEED-BORNE SEPTORIA (ALSO STAGONOSPORA)				
Seed Treatment			**per 100 kg seed**	
Infected seed is lightweight and shriveled. Fungicide seed treatment is very effective against this disease. Other options include the use of tolerant varieties and disease-free seed. Plant into a well-prepared seed bed under good growing conditions. Use wheat in at least a 3-year rotation since the disease can survive in wheat residue.	difenoconazole + metalaxyl-M	Dividend XL	130 mL	Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	650 mL	For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
FUSARIUM (SEED-BORNE, SEED ROT AND SEEDLING BLIGHT)				
Seed Treatment				
Infected seed is lightweight and shriveled. Fungicide seed treatment is very effective against this disease. Other options include the use of tolerant varieties and disease-free seed. Plant into a well-prepared seed bed under good growing conditions. Use wheat in at least a 3-year rotation since the disease can survive in wheat residue. Avoid planting wheat after corn.	tebuconazole	Raxil FL	180–240 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	325–650 mL	For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SEEDLING DISEASES				
COMMON ROOT ROT (COMMON BLIGHT)				
Seed Treatment			**per 100 kg seed**	
Infected plants can be found individually or in irregular patches. These plants are often stunted and yellow (chlorotic) with a dark browning or blacking of the subcrown internodes. Drought and warm temperatures favor root rot. Maintain sound soil heath practices and use good 3-year crop rotation using non-host crops. Avoid soil compaction and deep seeding.	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	For suppression only. Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	325–650 mL	For suppression only. For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
	tebuconazole	Raxil FL	240 mL	For suppression only. Do not graze or feed livestock on treated areas for 4 weeks after planting.
	carbathiin + thiram	Vitaflo 280	230–330 mL	For suppression only. Do not graze or feed livestock on treated areas for 4 weeks after planting.
	carbathiin + thiram + lindane	Vitaflo Dual Purpose	260 mL	For suppression only. Do not graze or feed livestock on treated areas for 4 weeks after planting. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
FUSARIUM CROWN AND FOOT ROT				
Seed Treatment Cool, dry soils are favourable for disease development. Delay planting until conditions will result in a rapid and uniform emergence. Avoid planting after corn and maintain a balanced fertility program. Seed should be treated.	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	325–650 mL	Suppression only. For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
PYTHIUM DAMPING OFF				
Seed Treatment Can occur on all soil types but losses are greatest in cold, wet, clay soils. Minimize soil compaction and remove excess moisture through increased drainage. Seed treatments containing metalaxyl or metalaxyl-M can reduce infection. Delay planting until conditions will result in a rapid and uniform emergence.	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
PYTHIUM DAMPING OFF (CONT'D)				
Seed Treatment (cont'd)			**per 100 kg seed**	
		Dividend XL RTA	325–650 mL	For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
	metalaxyl-M	Apron XL LS	20–40 mL	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or feed livestock on seeded area for 4 weeks after planting. Read label for information regarding resistant strains of fungus.
PENICILLIUM AND ASPERGILLUS SEED ROT				
Seed Treatment				
Both of these diseases are considered storage moulds. Their incidence increases when wheat is stored under warm temperatures and moist conditions. Seed that is damaged is especially susceptible under these conditions. Maintain grain at less than 14% moisture and below 20°C (68°F). Avoid damaging seed during harvest or handling.	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	325–650 mL	For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
DWARF BUNT				
Seed Treatment				
Occurs on winter wheat, primarily in counties bordering Georgian Bay and Lake Huron where snow cover is deep and persistent in late winter and early spring. Plant seed that is free of bunt spores (black). Treat seed when bunt has been observed in the crop. Cut high with the combine. Wheat infected with dwarf bunt will be substantially shorter than healthy plants. Infected seed has a "fishy" smell. Raising the header reduces the amount of bunt balls being harvested. Coverage of the seed with fungicide seed treatments is important to their effectiveness. Avoid planting wheat into fields with soilborne dwarf bunt for 5–7 years since the fungus is very persistent.	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	Both seed borne and soil borne control on winter wheat only. Good seed coverage and high rate of treatment necessary for soil-borne. Not for on-farm use. Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	325–650 mL	Both seed borne and soil borne control on winter wheat only. Good seed coverage and high rate of treatment necessary for soil-borne. For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
	carbathiin + thiram	Vitaflo 280	230–330 mL	Seed-borne only. Do not graze or feed livestock on treated areas for 4 weeks after planting.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
DWARF BUNT (CONT'D)				
Seed Treatment (cont'd)			**per 100 kg seed**	
	carbathiin + thiram + lindane	Vitaflo Dual Purpose	260 mL	Seed-borne only. Do not graze or feed livestock on treated areas for 4 weeks after planting. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
LOOSE SMUT				
Seed Treatment				
This fungus infects the embryo at flowering thus is seed-borne. Light rains or heavy dew and moderate temperature, 15°C–16°C (58°F–60°F) during flowering favour infection. Sow pedigree seed. This disease was quite important in Ontario wheat production but the incidence and hence its impact has been reduced substantially due to the effectiveness of fungicide seed treatments. Good coverage of seed with fungicide seed treatment important.	carbathiin + thiram	Vitaflo 280	330 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	carbathiin + thiram + lindane	Vitaflo Dual Purpose	260 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
	tebuconazole	Raxil FL	180– 240 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	325–650 mL	For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
	triadimenol	Baytan 30	50 mL	Must be diluted with water prior to treatment of seed to ensure uniform coverage. Treated seed will sometimes emerge slower than untreated. Avoid late seeding of winter cereals. Do not graze or feed livestock on treated areas for 40 days after planting.
TAKE-ALL				
Seed Treatment				
Carefully manage your soil fertility. Neutral to alkaline and infertile soils are most at risk. Do not apply lime before planting. Soils deficient in potassium and phosphorus cause plants to be more susceptible because of poor root development. Nitrate nitrogen increases disease severity. Control grasses and avoid early planting. Use a 3-year crop rotation and avoid planting wheat after wheat.	triadimenol	Baytan 30	100 mL	Suppression only. Must be diluted with water prior to treatment of seed to ensure uniform coverage. Treated seed will sometimes emerge slower than untreated. Avoid late seeding of winter cereals. Do not graze or feed livestock on treated areas for 40 days after planting.
	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	Suppression only. Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
TAKE-ALL (CONT'D)				
Seed Treatment (cont'd)			**per 100 kg seed**	
		Dividend XL RTA	325–650 mL	Suppression only. For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
COMMON BUNT				
Seed Treatment				
Cool soil temperatures after seeding favours this disease. This disease was quite important in Ontario wheat production but the incidence and hence its impact has been reduced substantially due to the effectiveness of fungicide seed treatments. Use seed that is free of bunt spores (black). Infected seed produces "fishy" smell.	carbathiin + thiram	Vitaflo 280	230–330 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	carbathiin + thiram + lindane	Vitaflo Dual Purpose	260 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
	difenoconazole + metalaxyl-M	Dividend XL	65–130 mL	Controls both seed and soil-borne common bunt. Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	325–650 mL	Controls both seed and soil-borne common bunt. For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
	tebuconazole	Raxil FL	180–240 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	triadimenol	Baytan 30	50 mL	Must be diluted with water prior to treatment of seed to ensure uniform coverage. Treated seed will sometimes emerge slower than untreated. Avoid late seeding of winter cereals. Do not graze or feed livestock on treated areas for 40 days after planting.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
FOLIAR, STEM AND HEAD DISEASES (See OMAF Publication 811, *Agronomy Guide for Field Crops* for Zadok's cereal growth stages)				
EARLY SEASON SEPTORIA SPP.				
Seed Treatment			**per 100 kg seed**	
Early season septoria control may reduce the risk of later infection. However, if the flag leaf is disease free at the time of head emergence, a fungicide will not likely be necessary. Foliar fungicides will not be necessary.	difenoconazole + metalaxyl-M	Dividend XL	130 mL	Winter wheat only. Provides control for the first 6 weeks after planting. For full-season control apply foliar fungicide. Do not use in hopper box, planter box, slurry box or other non-commercial seed treatment applications at or immediately before planting. Do not graze, feed green forage or cut for hay within 55 days of planting.
		Dividend XL RTA	650 mL	Winter wheat only. Provides control for the first 6 weeks after planting. For full-season control, apply a foliar fungicide. For both commercial seed treatment plants and on-farm treatment using standard gravity flow or mist type seed treatment equipment. May also be used in treat-on-the-go seeder. Do not graze, feed green forage or cut for hay within 55 days of planting.
LATE SEASON SEPTORIA SPP. (GLUME BLOTCH AND LEAF SPOT)				
Foliar treatment			**per ha (per ac)**	
Wet, windy weather and moderate temperatures favours disease development. Destroying volunteer wheat, reducing crop residue and crop rotation also helps reduce risk. Use less susceptible varieties. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for Zadok's cereal growth stages.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial. Apply at early signs of disease from tillering (Zadoks 21 growth stage) to head half emerged (Zadoks 55 growth stage). Can be tank mixed with several cereal herbicides. 45 days to harvest.
	mancozeb	Dithane DG Rainshield NT	1.1 kg — early (440 g) 2.25 kg —late (900 g)	Use lower rate for applications at Zadoks 12–21 growth stage, when crop is in 3rd leaf to tillering. Higher rate for applications at Zadoks 59 growth stage when head is fully emerged but prior to flowering. No more than 2 application/yr. 40 days to harvest. Do not graze crop or cut for hay.
POWDERY MILDEW				
Seed Treatment			**per 100 kg seed**	
Powdery mildew is favoured by warm, humid weather. Early season powdery mildew control may reduce the risk of later infection. However, if the flag leaf is disease free at the time of head emergence, a fungicide will not be necessary. In areas prone to severe mildew, use the more resistant varieties of winter wheat. Bury crop residue and rotate out of wheat for at least 2 years.	triadimenol	Baytan 30	50 mL 100 mL	Use higher rate for winter wheat. Must be diluted with water prior to treatment of seed to ensure uniform coverage. Treated seed will sometimes emerge slower than untreated. Avoid late seeding of winter cereals. Do not graze or feed livestock on treated areas for 40 days after planting.
Foliar Treatment			**per ha (per ac)**	
	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply at early signs of disease from tillering to head half emerged. Can be tank mixed with several cereal herbicides. 45 days to harvest.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
RUST (LEAF AND STEM)				
			per ha (per ac)	
Leaf rust blows in from the southern United States late in the season. Stem rust has common barberry as an alternate host therefore removing this alternate host will help minimize stem rust. Use tolerant varieties. Use foliar treatments when flag leaf has 5–10 pustules (1% leaf area). See OMAF Publication 811, *Agronomy Guide for Field Crops*, for Zadok's cereal growth stages.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply at early signs of disease from tillering to head half emerged. Can be tank mixed with several cereal herbicides. 45 days to harvest.
	mancozeb	Dithane DG Rainshield NT	1.1 kg — early (440 g) 2.25 kg — late (900 g)	Leaf rust only. Use lower rate for applications at Zadoks 12–21 growth stage, when crop is in 3rd leaf to tillering. Higher rate for applications at Zadoks 59 growth stage when head is fully emerged but prior to flowering. No more than 2 applications/yr. 40 days to harvest. Do not graze crop or cut for hay.
TAN SPOT				
Reduced tillage and cool, cloudy humid weather promotes this disease. This disease survives in crop residues. Avoid planting wheat in conservation tillage fields in which wheat was grown during the preceding 2 years. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for Zadok's cereal growth stages.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply at early signs of disease from tillering to head half emerged. Can be tank mixed with several cereal herbicides. 45 days to harvest.
	mancozeb	Dithane DG Rainshield NT	1.1 kg — early (440 g) 2.25 kg — late (900 g)	Use lower rate for applications at Zadoks 12–21 growth stage, when crop is in 3rd leaf to tillering. Higher rate for applications at Zadoks 59 growth stage when head is fully emerged but prior to flowering. No more than 2 applications/yr. 40 days to harvest. Do not graze crop or cut for hay.
FUSARIUM HEAD BLIGHT				
Warm and prolonged wet conditions during flowering are necessary for infection to occur. Avoid planting into corn stubble since the fungus also causes Gibberella stalk rot in corn. Wheat should follow soybeans in the rotation. See Fusarium forecasting Web page at www.ownweb.ca to determine the Fusarium head blight risk for your area and for current recommendations. Consult your local crop advisor for forecast information.				No registered products at this time.
SEPTORIA (STAGONOSPORA) GLUME BOTCH				
Prolonged wet periods in May and early June result in increased disease incidence. Rotation with crops other than cereals, plowing down of cereal residues and removal of volunteer wheat reduces survivability of the fungi.	chlorothalonil	Bravo 500	1.5–2.5 mL (0.6–1.0 L)	Apply at Zadok's growth stage 37 (flag leaf emergence) and repeat 10–14 days later at growth stage 51-55 (visible ear). A 3rd application at growth stage 59–69 (ear fully emerged) may be necessary if conditions favour disease spread. Maximum 3 applications/yr. 30 days to harvest.

TABLE 5–2. Barley, Oats and Rye Seed and Soil Applied Fungicide Recommendations

Active Ingredient	Products	Formulation	Diseases: Barley: Seed and Seedling Blight	Barley: Covered Smut	Barley: True Loose Smut	Oats: Covered Smut	Oats: Loose Smut	Rye: Fusarium Seedling Blight
INSECT AND DISEASE CONTROL								
Seed Treatments with Insecticides								
carbathiin + thiram + lindane	Vitavax Dual Purpose	F	+	+	+	—	—	—
DISEASE CONTROL								
carbathiin + thiram	Vitaflo 280	F	+	+	+	+	+	+
tebuconazole	Raxil FL	F	+[1]	+	+	—	—	—
triadimenol	Baytan 30	F	—	+	+	—	—	—

DB = Drill Box Application EC = Emulsifiable Concentrate F = Flowable P = Powder
+ = Recommended for disease listed — = Not Recommended [1] Also controls Fusarium seedling blight

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
BARLEY				
SEED ROT AND SEEDLING DISEASES				
SEED ROT AND SEEDLING BLIGHT				
Seed Treatment			**per 100 kg seed**	
Ensure good coverage of seed treatment on seeds. Rotation with non-host crops for at least 2 years will reduce risk. Use disease free seed and avoid deep seeding.	tebuconazole	Raxil FL	180–240 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	carbathiin + thiram	Vitaflo 280	230–330 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	carbathiin + thiram + lindane	Vitaflo Dual Purpose	325 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
COCHLIOBOLUS SEEDLING BLIGHT				
Seed Treatment			**per 100 kg seed**	
Avoid continuous or overuse of barley. Avoid deep seeding. Turn under stubble to help reduce infection levels. Use resistant varieties.	tebuconazole	Raxil FL	180–240 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
COVERED SMUT (COMMON BUNT)				
Seed Treatment				
Infection can occur at temperatures of 14°C–25°C (57°F– 68°F), especially when the soil moisture levels are high. Seed treatment is the primarily method of control.	tebuconazole	Raxil FL	180–240 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	triadimenol	Baytan 30	50 mL	Spring Barley. Must be diluted with water prior to treatment of seed to ensure uniform coverage. Treated seed will sometimes emerge slower than untreated. Avoid late seeding of winter cereals. Do not graze or feed livestock on treated areas for 40 days after planting.
	carbathiin + thiram	Vitaflo 280	230–330 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	carbathiin + thiram + lindane	Vitaflo Dual Purpose	325 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**
LOOSE SMUT				
Seed Treatment				
Infection occurs during flowering. Conditions that promote the disease are wet, cloudy weather and moderate temperatures 16°C–22°C, (60°F–72°F). Sow pedigree seed. Moist weather at flowering promotes this disease. Use seed treatment on seed known to have high levels of infection.	tebuconazole	Raxil FL	180–240 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	triadimenol	Baytan 30	50 mL	Must be diluted with water prior to treatment of seed to ensure uniform coverage. Treated seed will sometimes emerge slower than untreated. Avoid late seeding of winter cereals. Do not graze or feed livestock on treated areas for 40 days after planting.
	carbathiin + thiram	Vitaflo 280	330 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	carbathiin + thiram + lindane	Vitaflo Dual Purpose	325 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting. **This product will no longer be available for sale after Dec. 31, 2003 and use must cease after Dec. 31, 2004.**

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
FOLIAR, STEM AND HEAD DISEASES				
NET BLOTCH, SPOT BLOTCH, SCALD, SEPTORIA LEAF SPOT				
			per ha (per ac)	
Avoid growing barley after barley, wheat or grasses. Plow down stubble and straw and plant early to avoid serious disease in July.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply at early signs of disease from tillering to head half emerged. Can be tank mixed with several cereal herbicides. 45 days to harvest.
RUST (LEAF AND STEM)				
Leaf rust spores are blown in from the United States and in most years late planted fields are most likely to show the disease. Alternate host is barberry. Remove or destroy alternate host from fence rows, etc. Plant early.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply at early signs of disease from tillering to head half emerged. Can be tank mixed with several cereal herbicides. 45 days to harvest.
OATS				
SEED ROTS AND SEEDLING DISEASES				
COVERED SMUT (COMMON BUNT) LOOSE SMUT				
Seed Treatment			**per 100 kg seed**	
Spread from year to year primarily through infected seed. Wind blown spores will infect florets within season. Use a fungicide seed treatment on infected seed.	carbathiin + thiram	Vitaflo 280	330 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.
	tebuconazole	Raxil 250 FL	240–360 mL	For Loose Smut control only. Do not graze or feed livestock on treated areas for 4 weeks after planting.
LEAF, STEM AND HEAD DISEASES				
SEPTORIA LEAF SPOT				
			per ha (per ac)	
Avoid planting oats after oats or mixed grain. Humid, wet, windy weather promotes disease.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply at early signs of disease from tillering to head half emerged. 45 days to harvest.
CROWN (LEAF) RUST				
European buckthorn is the alternate host. Can be a problem in central and Eastern Ontario. Use resistant varieties. Plant early which allows plants to mature before inoculum levels become heavy. Remove or destroy buckthorn.	propiconazole	Tilt 250 E	500 mL (200 mL)	Ground and aerial application. Apply at early signs of disease from tillering to head half emerged. 45 days to harvest.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
RYE				
SEEDLING BLIGHT				
Seed Treatment			**per 100 kg seed**	
Sow into a well prepared seed bed under good growing conditions. Avoid cool, wet conditions that will reduce emergence and increase seed rots and blights. Treat seed with a fungicide seed treatment.	carbathiin + thiram	Vitaflo 280	230–330 mL	Do not graze or feed livestock on treated areas for 4 weeks after planting.

6. Dry Edible Beans

INSECTS

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SEEDCORN MAGGOT				
Seed Treatment			per ha (per ac)	
Seedcorn maggot problems are rare in Ontario. Risk factors include cool, wet springs when germination is delayed. Expect only 60%–70% control when using seed treatments.	diazinon + captan + thiophanate-methyl	DCT	1 L of slurry	Available as 400 g container and will treat 77 kg of dry bean seed. Use full rate and ensure good coverage by applying as a slurry. To make slurry, use 520 g seed treatment per litre of water.
GREEN CLOVERWORM				
Several natural enemies help to keep populations below action thresholds. Insecticides are only recommended if populations are extremely high, as they will also kill the natural enemy population.	endosulfan	Thiodan 4 EC	1.5–2.5 L (0.6–1.0 L)	Do not apply on lima beans. Do not feed treated threshings or crop refuse to livestock. 2 days to harvest.
MEXICAN BEAN BEETLE				
Less of a problem in very hot, dry summers. Early maturing bean varieties and fall plantings may be grown with little or no injury. Several natural enemies help to keep populations below action thresholds. Insecticides are only recommended if populations are extremely high, as they will also kill the natural enemy population.	dimethoate	Cygon 4 E	0.7–1.0 L (280–400 mL)	Do not feed treated threshings or crop refuse to livestock. 7 days to harvest.
		Lagon 480 EC	0.7–1.0 L (280–400 mL)	Do not feed treated threshings or crop refuse to livestock. 7 days to harvest.
POTATO LEAFHOPPER				
Soil Applied at Planting Only				
Some tolerant varieties available. See OMAF Publication *811, Agronomy Guide for Field Crops*, for action threshold charts and sampling methods.	phorate	Thimet 15 G	7.25–11 kg (2.9–4.4 kg)	Lock and load. Must be applied in a 10–15 cm band over the row behind the planter shoe, in front of the press wheel. Do not place in direct contact with seed. Do not feed the foliage of treated beans within 60 days.
Foliar Treatment	dimethoate	Cygon 4 E	0.7–1.0 L (280–400 mL)	Do not feed treated threshings or crop refuse to livestock. 7 days to harvest.
		Lagon 480 EC	0.7–1.0 L (280–400 mL)	Do not feed treated threshings or crop refuse to livestock. 7 days to harvest.

TABLE 6–1. Edible Bean Seed and Soil Applied Fungicide Recommendations

Active Ingredients	Product	Formulation	Dry Edible Bean Diseases		
			Pythium Damping off	Anthracnose	Fusarium Seedling Blight
INSECT AND DISEASE CONTROL					
Untreated Seed					
diazinon + captan	Agrox B-2	P (DB)	—	—	+
diazinon + captan + thiophanate-methyl	DCT[1]	P	—	+	+
Seed Pretreated with Fungicide					
diazinon + captan	Agrox CD		**For insect control only. Disease control via fungicide pretreatment.**		
DISEASE CONTROL					
carbathiin + thiram	Vitaflo 280	LS	—	—	+
metalaxyl	Apron FL	F	+	—	—
metalaxyl – M	Apron XL	LS	+	—	—

DB = Drill Box Application EC = Emulsifiable Concentrate F = Flowable P = Powder LS = Liquid Suspension
+ = Recommended for disease listed — = Not Recommended
1 Due to anthracnose, all edible beans **MUST** be treated with DCT.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SEED ROTS AND SEEDLING DISEASES				
SEEDLING DISEASES				
			per 100 kg seed	
Present in all fields and all soil types. Maintain or build up good soil tilth by following a good crop rotation (3 years between bean crops of any kind), don't overwork the soil and avoiding working it when it is too wet. Apply seed treatments that will help to protect the plant from root rots during germination and early growth. Use tolerant varieties.	diazinon + captan + thiophanate-methyl	DCT	1 L of slurry	Due to anthracnose, all edible beans **MUST** be treated with DCT. Seedling blights and damping off are also controlled. Use full rate and ensure good coverage by applying as a slurry. Available as 400 g container and will treat 77 kg of dry bean seed. To make slurry, use 520 g seed treatment per litre of water. For control of Pythium and Phytophthora root rots, add metalaxyl.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
PYTHIUM DAMPING OFF				
			per 100 kg seed	
Can occur on all soil types but losses are greatest on wet, clay soils. Minimize soil compaction and remove excess moisture through increased drainage. Seed should be treated with metalaxyl or metalaxyl-M and plant into warm soils 16°C (60°F). Rotate 3–4 years between bean crops.	metalaxyl-M	Apron XL LS	20–40 mL Apply with DCT	Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or feed livestock on seeded area for 4 weeks after planting. Read label for information regarding resistant strains of fungus.
	metalaxyl	Allegiance FL Apron FL	46–110 mL 46–110 mL Apply with DCT	Do not graze or feed livestock on seeded area for 4 weeks after planting.
FUSARIUM SEED AND ROOT ROT				
Seed Treatment Fusarium begins as small reddish, brown lesions on the taproot which join to form larger lesions or streaks as the plant ages. The lesion can extend up to the soil line. Splitting of the tap root, crown and lower stem often reveals a brown-reddish internal discoloration of the water conducting tissue. Longitudinal cracks and adventious roots may develop on damaged plants. These adventitious roots are formed above the damaged area. Late infection seldom results in dead plants but rather in stunted, unthrifty looking ones. Disease development is promoted by soil compaction, short crop rotations and moisture stress.	carbathiin + thriam	Vitaflo 280	260 mL	**No insect control**. Ensure good seed coverage.
	diazinon + captan + thiophanate-methyl	DCT	1 L of slurry	Due to anthracnose, all edible beans **MUST** be treated with DCT. Seedling blights and damping off are also controlled. Use full rate and ensure good coverage by applying as a slurry. Available as 400 g container and will treat 77 kg of dry bean seed. To make slurry, use 520 g seed treatment per litre of water. For control of Pythium and Phytophthora root rots, add metalaxyl.
	diazinon + captan	Agrox B-2	320 mL	Available as a 2 kg container and will treat 625 kg of bean seed. Use full rate and ensure good coverage of seed. Seed within one month of treatment. Do not use on seed already treated with an insecticide.
ANTHRACNOSE				
Plant disease-free resistant varieties that have been treated with DCT. Stay out of bean fields when plants are wet since the disease can be spread by farm machinery, animals and humans, both within the field and between an infected field and a non-infected field. Incorporate infected bean debris. Rainy conditions favour disease development and increases potential spread. Rotate 3–4 years between edible bean crops.	diazinon + captan + triophanate-methyl	DCT	1 L of slurry	Available as 400 g container and will treat 77 kg of dry bean seed. Use full rate and ensure good coverage by applying as a slurry. To make slurry, use 520 g seed treatment per litre of water.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
FOLIAR, STEM AND POD DISEASES				
WHITE MOULD				
			per ha (per ac)	
Avoid soybeans, canola and other hosts in a three year rotation since these crops are susceptible to white mould. Rotate with non host crops such as wheat, corn and barley. In fields with a history of the disease, select varieties with an upright structure. Lower plant populations and increased row width promote rapid drying of the plants and soil surface and therefore reduces potential for infection. Avoid excess fertilization. Those fields at risk have a past history of white mould and above average foliage growth.	vinclozolin	Ronilan EG	1.0 kg (400 g) 2 app./yr 1.5 kg (600 g) 1 app./yr	Apply at 30%–50% flowering with repeat application 7–14 days later at full bloom if disease persists. For one application, apply 1.5 kg at early to mid-bloom (30%–50%). Do not feed treated bean refuse to livestock. Use sufficient water to ensure thorough coverage of plant foliage. Do not apply with products containing boron. 45 days to harvest for common, adzuki and mung beans.
	iprodione	Rovral WP	1.0–1.5 kg (0.4–0.6 kg)	Apply at 25%–75% bloom. 12 hr re-entry period. Do not feed treated bean refuse to livestock.
	thiophanate-methyl	Senator 70 WP	1.75–2.25 kg (700–900 g)	Apply when conditions favouring development of disease exist (warm, humid weather combined with heavy, dense crop foliage). Do not feed treated bean refuse to livestock. 14 days to harvest.
	benomyl	Benlate Toss-N-GO	1.75–2.25 kg (700–900 g)	Apply between 25% and 50% bloom stage with enough water to obtain thorough coverage. Use higher rate for severe disease conditions. Do not tank-mix or alternate Benlate with thiophanate products. Always use Benlate tank-mixed with other suitable fungicides such as Manzate 200. Apply mixture same day. No more than 2 applications/yr. Do not graze or feed treated bean refuse to livestock. 14 days to harvest.
	dicloran	Botran 75 WP	3.25 kg (1.3 kg)	Begin application when disease is anticipated, usually close to full bloom. Do not feed treated bean refuse to livestock. 2 days to harvest.

7. Canola and Mustard

INSECTS

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
FLEA BEETLES				
Seed Treatment			**per 100 kg seed**	
Hot, dry weather favours this pest. Fortunately, once the crop reaches the 3–4 leaf stage, the plants are generally established and can compensate for the feeding damage. If beetle damage exceeds 50% of the cotyledon or leaf area, and if the weather is warm and dry, a foliar insecticide may be needed. Canola and mustard are a valuable honey source and is well used by honeybees. Keep insecticide application to a minimum while the crop is in bloom.	imidacloprid	Gaucho 480 FL	820–1640 mL	Not for use in hopper box, planter box, slurry box or other non-commercial seed treatment application. Do not graze livestock on treated areas for 4 weeks after planting. Mustard greens having Gaucho 480 FL seed treatment must not be used for human consumption. Use higher rate if flea beetle populations are high.
	thiamethoxam + difenoconazole +metalxyl M + fludioxonil	Helix Xtra	1.5 L	Not for use in hopper box, planter box, slurry box or other non-commercial seed treatment application. Follow resistance management recommendations as stated on label.
	imidacloprid + carbaithiin + thiram	Gaucho CS FL	1.4 L	Not for use in hopper box, planter box, slurry box or other non-commercial seed treatment application. Do not graze livestock on treated areas for 4 weeks after planting. Mustard greens having Gaucho CS seed treatment must not be used for human consumption. Follow resistance management recommendations as stated on label.
Soil Applied at Planting Only			**per ha (per ac)**	
	terbufos	Counter 5 G	5.5–11 kg (2.2–4.4 kg)	Seed-furrow treatment at planting time only. If high infestations are anticipated, use the higher rate. Use higher rate when using discer or air-seeder.
Postemergence	cypermethrin	Cymbush 250 EC	140 mL (57 mL)	Ripcord is registered for use on canola only. Ground and aerial application. 30 days to harvest. Ground application only. Apply when signs of insect damage appear. Repeat treatment if necessary. Use minimum 110 L of water per hectare. 30 days to harvest.
		Ripcord 400 EC	50 mL (20 mL)	
	deltamethrin	Decis 5 EC	100–150 mL (40–60 mL)	Ground and aerial application. 14 days to harvest.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
FLEA BEETLES (CONT'D)				
			per ha (per ac)	
Postemergence (cont'd)	cyhalothrin-lambda	Matador 120 EC	83 mL (33 mL)	Ground and aerial application. Maximum 3 applications/yr., 1 may be by air. Do not apply within 50 days of harvest.
	carbaryl	Sevin XLR Plus	500 mL (200 mL)	Seedling stage only (up to 4 weeks after plant emergence). Ground and aerial application. 60 days to harvest.
	carbofuran	Furadan 480 F	150 mL (60 mL)	Apply 2 weeks after seeding or when insects first noticed. Ground and aerial application. Do not use less than 100 L of water. 60 days to harvest for canola and 21 days to harvest or grazing on mustard. Minimum period for re-entry is 48 hr.
DIAMONDBACK MOTH				
Damage is most noticeable during dry years. Risk factors include weedy fields and no-till. Cool, cloudy weather reduces moth activity and if this persists, females will die before eggs are laid. Canola is a valuable honey source and is utilized by honeybees. Bees also pollinate the crop. If spraying an insecticide, ensure there are no honey producing hives in your area.	trichlorfon	Dylox 420 L	2.75 L (1.1 L)	Canola only. Ground application only. Use if canola is in bloom because it is less hazardous to bees. 21 days to harvest.

DISEASES

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SEEDLING DISEASES				
SEED ROT AND SEEDLING BLIGHT (ALTERNARIA AND RHIZOCTONIA)				
Plant good quality seed when the conditions are good (warm) that promote rapid germination. Using a fungicide seed treatment will increase stand establishment. Maintain a good fertility balance and avoid excess fertilizer which promote disease and phytotoxicities. Avoid deep planting of seed.			**per 100 kg seed**	
	thiamethoxam + difenoconazole + metalxyl M + fludioxonil	Helix Xtra	1.5 L	Not for use in hopper box, planter box, slurry box or other non-commercial seed treatment application. Follow resistance management recommendations as stated on label.
	carbathiin + thiram	Vitavax RS Fungicide	833 mL	Do not graze or feed livestock on seed area for 4 weeks after planting.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SEED ROT AND SEEDLING BLIGHT (ALTERNARIA AND RHIZOCTONIA) (CONT'D)				
			per 100 kg seed	
	imidacloprid + carbaithiin + thiram	Gaucho CS FL	1.4 L	Not for use in hopper box, planter box, slurry box or other non-commercial seed treatment application. Do not graze livestock on treated areas for 4 weeks after planting. Mustard greens having Gaucho CS seed treatment must not be used for human consumption. Follow resistance management recommendations as stated on label.
PYTHIUM DAMPING-OFF				
Plant good quality seed when the conditions are good (warm) that promote rapid germination. Using metalaxyl or metalaxyl-M seed treatment will increase stand establishment. Maintain a good fertility balance and avoid excess fertilizer which promote disease and phytotoxicities. Avoid deep planting of seed.	metalaxyl-M	Apron XL LS	20–40 mL	Canola only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Read label for information regarding resistant strains of fungus.
	metalaxyl	Apron FL	32–110 mL	Canola only. Do not graze or feed livestock on seeded area for 4 weeks after planting.
	thiamethoxam + difenoconazole + metalxyl M + fludioxonil	Helix Xtra	1.5 L	Not for use in hopper box, planter box, slurry box or other non-commercial seed treatment application. Follow resistance management recommendations as stated on label.
BLACKLEG				
Seed Treatment			**per 100 kg seed**	
There are differences in susceptibility between cultivars. Maintain at least 3 years between canola crops. Fungicide seed treatments will reduce seed-borne infection.	thiamethoxam + difenoconazole +metalxyl M + fludioxonil	Helix Xtra	1.5 L	Not for use in hopper box, planter box, slurry box or other non-commercial seed treatment application. Follow resistance management recommendations as stated on label.
	carbathiin + thiram	Vitavax RS Fungicide	833 mL	Do not graze or feed livestock on seed area for 4 weeks after planting.
	imidacloprid + carbaithiin + thiram	Gaucho CS FL	1.4 L	Not for use in hopper box, planter box, slurry box or other non-commercial seed treatment application. Do not graze livestock on treated areas for 4 weeks after planting. Mustard greens having Gaucho CS seed treatment must not be used for human consumption. Follow resistance management recommendations as stated on label.
Foliar Treatment			**per ha (per ac)**	
	propiconazole	Tilt 250 E	500 mL (200 mL)	Canola only. Ground and aerial application. Apply at rosette stage. Do not feed treated canola refuse to livestock. 60 days to harvest.
	azoxystrobin	Quadris	500 mL (200 mL)	Canola only. Apply at 2–6 leaf stage. See label for information regarding resistant strains of fungus. Plantback interval of 30 days for broadleaf and root crops and 45 days for cereals required. 30 days to harvest.

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
SCLEROTINIA STEM ROT (WHITE MOULD)				
			per ha (per ac)	
The disease is often a problem when canola follows canola, white beans, soybeans or sunflowers. Use clean seed and a 4–5 year rotation with non-host crops such as corn, wheat, barley or oats. At present, no resistant varieties exist. Keep fields clean of broad-leaved weeds since many are alternate hosts.	vinclozolin	Ronilan EG	0.5 kg (0.2 kg) for 2 applications 0.75–1.0 kg (300–400 g) for 1 application	Canola only. For two applications, apply first at 20%–30% flowering and second 7 days later at late bloom (50%) if disease persists. For single application at higher rates, apply at 20%–50% flower. Use the high rate where conditions are extremely favourable for disease development (heavy crop canopy, high humidity and/or excessive rainfall). Do not feed treated canola refuse to livestock. Use sufficient water to ensure thorough coverage of plant foliage. Do not apply with products containing boron. 40 days to harvest.
	iprodione	Rovral WP	1.0–1.5 kg (0.4–0.6 kg)	Canola only. Ground and aerial application. Apply at 20%–30% bloom. 12 hour re-entry period.
	azoxystrobin	Quadris	700–1000 mL (283–405 mL)	Canola only. Apply at early bloom (prior to 30% bloom). See label for information regarding resistant strains of fungus. Plantback interval of 30 days for broadleaf and root crops and 45 days for cereals required. 30 days to harvest.
	benomyl	Benlate Toss-N-GO	1.0–1.5 kg (400–600 g)	Canola only. Apply during 20%–30% bloom stage. Do not tank-mix or alternate Benlate with thiophanate products. Always use Benlate tank-mixed with other suitable fungicides such as Manzate 200. Apply mixture same day. No more than 2 applications/yr. Do not feed treated canola refuse to livestock.

8. Stored Grain

INSECTS

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
CORN, WHEAT AND SOYBEANS				
RUSTY GRAIN BEETLE				
Protectant The key to controlling stored grain insects is prevention through good sanitation and storage practices. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more information on Stored Grain Insect Management.	diatomaceous earth	Protect-It	*Empty bin:* 500 per 100 m^2 *Stored grain:* 500–1000 g/ metric tonne of grain.	Can be applied to dry containers where grain is transported or stored. The structure must remain empty for 1–2 weeks. For maximum effectiveness, the relative humidity must remain below 55% and the temperature above 15°C (59°F). See label for spot and crack treatment rates. For wheat grain treatment, 100 g per metric tonne of wheat can be used to control rusty grain beetle. Dust may be applied to grain as it enters the auger or conveyor feeder system during grain transfer into storage facility.
Fumigant			**per 100 m^3**	
	aluminum phosphide		*Grain bin:*	Must be applied by a professional licensed applicator. Do not fumigate below 5°C (40°F). Exposure to moist air or liquids releases flammable and toxic phosphine gas. Ensure bin is tightly sealed. Not to be used for vacuum fumigations. See label for minimum length of pest exposure periods at various temperatures.
		Fumitoxin	880–2560 pellets 250–500 tablets	
		Phostoxin	880–2560 pellets 250–500 tablets	
		Gastoxin	880–2500 pellets 180–500 tablets	

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
INDIAN MEAL MOTH				
Protectant The key to controlling stored grain insects is prevention through good sanitation and storage practices. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more information on Stored Grain Insect Management.	diatomaceous earth	Protect-It	*Empty bin:* 500 per 100 m^2 *Stored grain:* 500–1000 g per metric tonne of grain.	Apply at monthly intervals with the first appearance of moths and continue until early fall. In severe infestations, break up webbing with a rake before dusting and make second application 2 weeks later. Can be applied to dry containers where grain is transported or stored. The structure must remain empty for 1–2 weeks. For maximum effectiveness, the relative humidity must remain below 55% and the temperature above 15°C (59°F). See label for spot and crack treatment rates. Dust may be applied to grain as it enters the auger or conveyor feeder system during grain transfer into storage facility.
Fumigant			**per 100 m^3**	
	aluminum phosphide	Fumitoxin	*Grain bin:* 880–2560 pellets 250–500 tablets	Must be applied by a professional licensed applicator. Do not fumigate below 5°C (40°F). Exposure to moist air or liquids releases flammable and toxic phosphine gas. Ensure bin is as tightly sealed as possible. Not to be used for vacuum fumigations. See label for minimum length of pest exposure periods at various temperatures.
		Phostoxin	880–2560 pellets 250–500 tablets	
		Gastoxin	880–2500 pellets 180–500 tablets	
GRANARY WEEVIL				
Protectant The key to controlling stored grain insects is prevention through good sanitation and storage practices. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more information on Stored Grain Insect Management.	diatomaceous earth	Protect-It	*Empty bin:* 500 g per 100 m^2 *Stored grain:* 500–1000 g per metric tonne of grain.	Can be applied to dry containers where grain is transported or stored. The structure must remain empty for 1–2 weeks. For maximum effectiveness, the relative humidity must remain below 55% and the temperature above 15°C (59°F). See label for spot and crack treatment rates. Dust may be applied to grain as it enters the auger or conveyor feeder system during grain transfer into storage facility.
Fumigant			**per 100 m^3**	
	aluminum phosphide	Fumitoxin	*Grain bin:* 880–2560 pellets 250–500 tablets	Must be applied by a professional licensed applicator. Do not fumigate below 5°C (40°F). Exposure to moist air or liquids releases flammable and toxic phosphine gas. Ensure bin is as tightly sealed as possible. Not to be used for vacuum fumigations. See label for minimum length of pest exposure periods at various temperatures.
		Phostoxin	880–2560 pellets 250–500 tablets	
		Gastoxin	880–2500 pellets 180–500 tablets	

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (Days to harvest, label precautions, etc.)
LESSER GRAIN BORER				
Fumigant			**per 100 m^3**	
The key to controlling stored grain insects is prevention through good sanitation and storage practices. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more information on Stored Grain Insect Management.	aluminum phosphide	Fumitoxin Phostoxin Gastoxin	*Grain bin:* 880–2560 pellets 250–500 tablets 880–2560 pellets 250–500 tablets 880–2500 pellets 180–500 tablets	Must be applied by a professional licensed applicator. Do not fumigate below 5°C (40°F). Exposure to moist air or liquids releases flammable and toxic phosphine gas. Ensure bin is as tightly sealed as possible. Not to be used for vacuum fumigations. See label for minimum length of pest exposure periods at various temperatures.
PEA/BEAN WEEVILS				
Fumigant The key to controlling stored grain insects is prevention through good sanitation and storage practices. See OMAF Publication 811, *Agronomy Guide for Field Crops*, for more information on Stored Grain Insect Management.	aluminum phosphide	Fumitoxin Phostoxin Gastoxin	*Grain bin:* 880–2560 pellets 250–500 tablets 880–2560 pellets 250–500 tablets 880–2500 pellets 180–500 tablets	Must be applied by a professional licensed applicator. Do not fumigate below 5°C (40°F). Exposure to moist air or liquids releases flammable and toxic phosphine gas. Ensure bin is as tightly sealed as possible. Not to be used for vacuum fumigations. See label for minimum length of pest exposure periods at various temperatures.

9. Appendices

APPENDIX A. Manufacturers of Pesticides Recommendation in Publication 812

BASF Canada Inc.
345 Carlingview Drive
Toronto, Ontario M9W 6N9
Tel 1-800-485-2273
Fax (416) 674-2588
www.basf.com/basf-canada

Bayer CropScience
100-3131 114th Avenue SE
Calgary, Alberta T2Z 3X2
Tel 1-888-283-6847
Fax (403) 723-7488
www.bayer.ca/agriculture

Dow AgroSciences Solutions Centre
#201-1144 29th Avenue NE
Calgary, Alberta T2E 7P1
Tel 1-800-667-3852
(403) 735-8800
Fax 1-888-296-6188
www.dowagro.ca

DuPont Canada Inc.
7070 Mississauga Road, Box 2300
Streetsville, Ontario L5M 2H3
Tel 1-800-387-2122
(905) 821-5679
Fax (905) 821-5653
http://ca.dupont.com

Engage Agro Corp.
848 Gordon Street
Guelph, Ontario N1G 1Y7
Tel (519) 826-7878
Fax (519) 826-7675
www.engageagro.com

Gowan Company
370 South Main St.
Yuma, Arizona 85364 USA
Tel 1-800-883-1844, ext. 2
www.gowanco.com

Growmark Inc.
2000 Argentia Road
P.O. Box 634
Mississauga, Ontario L5M 2C1
Tel (905) 814-4266
Fax (905) 814-4341
www.growmark.com

Gustafson Partnership
5-160 Research Lane
Guelph Ontario N1G 5B2
Tel (519) 767-3366
Fax (519) 767-9598
www.gustafson.ca

Interprovincial Cooperative Ltd.
945 Marion St.
Winnipeg, Manitoba R2J 0K7
Tel (204) 233-3461

Monsanto Canada
67 Scurfield Blvd.
Winnepeg, Manitoba R37 1G4
Tel 1-800-667-4944
Fax (204) 488-9599

Norac Concepts Inc.
P.O. Box 62023
Orleans ON K1C 7H8
Tel (613) 841-2907
Fax (613) 841-2908
www.noracconcepts.com

Syngenta Crop Protection Canada Inc.
140 Research Lane
University of Guelph
Guelph, Ontario N1G 4Z3
Tel 1-800-459-2422
Fax (519) 823-8439
www.syngenta.ca

Syngenta Seeds Canada Inc.
15910 Medway Road
Arva, Ontario N0M 1C0
Tel 1-800-756-7333
Fax 1-888-717-7122
www.nkcanada.com

Thermo Trilogy Corporation
9145 Guilford Road, Suite 175
Columbia, MD 21046 USA
www.thermotrilogy.com

United Agri Products
789 Donnybrook Drive
Dorchester, Ontario N0L 1G5
Tel 1-800-265-4624
(519) 268-8001
Fax (519) 268-8013
www.uap.ca

Valent BioSciences Canada Ltd.
19 Wildan Drive
Box 19
Freelton, Ontario L0R 1K0
Tel (905) 659-0886
Fax (905) 659-0885
www.valentbiosciences.com

APPENDIX B. Ontario Ministry of Agriculture and Food Advisory Staff List

Brighton Resource Centre			
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IPM Systems Specialist	Margaret Appleby	(613) 475-5850	margaret.appleby@omaf.gov.on.ca
Delhi			
General Phone (519) 582-7220	**Fax (519) 582-4504**	Southern Crop Protection and Food Research Centre Schafer Rd. Box 186 Delhi, ON N4B 2W9	
IPM Specialist – Specialty Crops	Denise Beaton	(519) 582-7220 ext. 263	denise.beaton@omaf.gov.on.ca
Tobacco Specialist	Dan Ramer	(519) 582-7220 ext. 264	dan.ramer@omaf.gov.on.ca
Fergus Resource Centre			
General Phone (519) 846-0941	**Fax (519) 846-8178**	RR#1, County Road 18, Wellington Place Fergus, ON N1M 2W3	
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Crop Protection Program Lead	Vacant		
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Organic Crop Production Program Lead	Hugh Martin	(519) 826-4587 Fax: (519) 826-4964	hugh.martin@omaf.gov.on.ca
Potato Specialist	Dr. Eugenia Banks	(519) 826-3678 Fax (519) 826-4964	eugenia.banks@omaf.gov.on.ca
Product Development Specialist	Kelly Ward	(519) 826-4094 Fax (519) 826-4964	kelly.ward@omaf.gov.on.ca
Vegetable Crops Specialist	Kristen Callow	(519) 826-4963 Fax (519) 826-4964	kristen.callow@omaf.gov.on.ca

APPENDIX B. Ontario Ministry of Agriculture and Food Advisory Staff List (Continued)

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Greenhouse Vegetable IPM Specialist	Gillian Ferguson	(519) 738-2251 ext. 406	gillian.ferguson@omaf.gov.on.ca
Greenhouse Vegetable Specialist	Shalin Khosla	(519) 738-2251 ext. 405	shalin.khosla@omaf.gov.on.ca
Weed Management – Horticulture Program Lead	Leslie Huffman	(519) 738-2251 ext. 499	leslie.huffman@omaf.gov.on.ca
Kemptville Resource Centre			
General Phone (613) 258-8295	**Fax (613) 258-8392**	Box 2004, Concession Rd Kemptville, ON K0G 1J0	
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Lindsay Resource Centre			
General Phone (705) 324-6125	**Fax (705) 324-1638**	322 Kent St. W Lindsay, ON K9V 2Z9	
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London Resource Centre			
General Phone (519) 873-4070	**Fax (519) 873-4062**	667 Exeter Road London, ON N6E 1L3	
Apple Specialist	John Gardner	(519) 873-4084	john.gardner@omaf.gov.on.ca
New Liskeard			
General Phone (800) 461-6132	**Fax (705) 647-7993**	280 Armstrong St. Box 4070, New Liskeard, ON P0J 1P0	
Agriculture and Rural Representative	Daniel Tassé	(705) 647-2085	daniel.tasse@omaf.gov.on.ca
Ridgetown Resource Centre			
General Phone (519) 674-1690	**Fax (519) 674-1564**	Agronomy Building, Ridgetown College Box 400, Main St. E Ridgetown, ON N0P 2C0	
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IPM Modelling Specialist	Vacant	(519) 674-1694	
Pathologist – Field Crops Program Lead	Albert Tenuta	(519) 674-1617	albert.tenuta@omaf.gov.on.ca
Soil Management Specialist – Field Crops	Adam Hayes	(519) 674-1621	adam.hayes@omaf.gov.on.ca
Soil Management Specialist – Horticulture	Anne Verhallen	(519) 674-1614	anne.verhallen@omaf.gov.on.ca
Vegetable Crops Specialist	Janice LeBoeuf	(519) 674-1699	janice.leboeuf@omaf.gov.on.ca
Vegetable Crops Specialist	Elaine Roddy	(519) 674-1616	elaine.roddy@omaf.gov.on.ca
Simcoe Resource Centre			
General Phone (519) 426-7120	**Fax (519) 428-1142**	P.O. Box 587 Blueline Rd & Hwy #3 Simcoe, ON N3Y 4N5	
Berry Crop Specialist	Pam Fisher	(519) 426-2238	pam.fisher@omaf.gov.on.ca
Fresh Market Quality Program Lead	Dr. Jennifer R. DeEll	(519) 426-4322	jennifer.deell@omaf.gov.on.ca
Ginseng and Medicinal Herbs Specialist	Jan Schooley	(519) 426-4323	jan.schooley@omaf.gov.on.ca
New Crop Development Specialist	Mike Columbus	(519) 426-4509	mike.columbus@omaf.gov.on.ca
Pome Fruit IPM Specialist (Acting)	Kathryn Carter	(519) 426-4322	kathryn.carter@omaf.gov.on.ca

APPENDIX B. Ontario Ministry of Agriculture and Food Advisory Staff List (Continued)

Stratford Resource Centre			
General Phone (519) 271-0280 Fax (519) 273-5278		581 Huron St. Stratford, ON N5A 5T8	
Alternate Production Systems Specialist	Brian Hall	(519) 271-0083	brian.hall@omaf.gov.on.ca
Biosolids Specialist	Michael Payne	(519) 271-4496	michael.payne@omaf.gov.on.ca
Cereals Specialist	Peter Johnson	(519) 271-8180	peter.johnson@omaf.gov.on.ca
Soil Fertility Specialist	Keith Reid (on secondment)	(519) 271-9269	keith.reid@omaf.gov.on.ca
Soybean Specialist	Horst Bohner	(519) 271-5858	horst.bohner@omaf.gov.on.ca
Vineland - HRIO, University of Guelph			
General Phone (905) 562-4141 Fax (905) 562-3413		Box 7000 4890 Victoria Ave. N Vineland Station L0R 2E0	
Greenhouse Floriculture Specialist	Wayne Brown	(905) 562-4141 ext. 179	wayne.brown@omaf.gov.on.ca
Greenhouse Floriculture IPM Specialist	Graeme Murphy	(905) 562-4141 ext. 106	graeme.murphy@omaf.gov.on.ca
Vineland Resource Centre			
General Phone (905) 562-4147 Fax (905) 562-5933		Adv. Serv. Building, Box 8000, 4890 Victoria Avenue, North Vineland Station, ON L0R 2E0	
Entomology, Horticulture Program Lead	Hannah Fraser	(905) 562-1674	hannah.fraser@omaf.gov.on.ca
Nutrient Management Horticulture Crops Program Lead	Jacinta Dano	(905) 562-1170	jacinta.dano@omaf.gov.on.ca
Tender Fruit and Grape IPM Specialist	Neil Carter	(905) 562-3833	neil.carter@omaf.gov.on.ca
Tender Fruit and Grape Specialist	Ken Slingerland	(905) 562-1639	ken.slingerland@omaf.gov.on.ca
Woodstock Resource Centre			
General Phone (519) 537-6621 Fax (519) 539-5351		Box 666, Hwy. #59 N Woodstock, ON N4S 7Z5	
Nutrient Management Field Crops Program Lead	Tom McCann	(519) 537-6592	tom.mccann@omaf.gov.on.ca
University of Guelph			
General Phone (519) 824-4120		50 Stone Road East Guelph, ON N1G 2W1	
Applied Research Coordinator – Field Crops, Crop Science Building	Ian McDonald	(519) 824-4120 ext.56707 Fax (519) 763-8933	ian.mcdonald@omaf.gov.on.ca
Corn Industry Program Lead Crop Science Building	Greg Stewart	(519) 824-4120 ext. 54865 Fax (519) 763-8933	greg.stewart@omaf.gov.on.ca
Nursery Crops Specialist Edmund Bovey Building	Jennifer Llewellyn	(519) 824-4120 ext. 52671 Fax (519) 767-0755	jennifer.llewellyn@omaf.gov.on.ca
Nutrition – Horticulture Program Lead Land Resource Science, Richards Building	Christoph Kessel	(519) 824-4120 ext. 52480 Fax (519) 824-5730	christoph.kessel@omaf.gov.on.ca
Pathologist – Horticulture Crops Program Lead, Edmund Bovey Building	Michael Celetti	(519) 824-4120 ext. 58910 Fax (519) 767-0755	michael.celetti@omaf.gov.on.ca
Turfgrass Specialist , Guelph Turfgrass Institute 328 Victoria Rd S R. R. # 2 Guelph, ON N1H 6H8	Pam Charbonneau	(519) 824-4120 ext. 52597 Fax (519) 766-1704	pamela.charbonneau@omaf.gov.on.ca
Weed Management Field Crops Program Lead, Crop Science Building, Room 303	Mike Cowbrough	(519) 824-4120 ext. 52580 Fax (519) 763-8933	mike.cowbrough@omaf.gov.on.ca

Agricultural Information Contact Centre
General Phone (877) 424-1300 or (519) 826-4047 Fax (519) 826-7610

Provides province-wide, toll-free technical and business information to commercial farms, agri-businesses and rural businesses.

1 Stone Road, West Guelph ON N1G 4Y2 e-mail ag.info@omaf.gov.on.ca

Guelph — Government Information Centre and Publication Order Centre
Staff Directories — Phone 1-888-466-2372 or (519) 826-3100
1 Stone Road West Guelph ON N1G 4Y2

APPENDIX C. Ontario Classification Schedules

Explanation of Schedules	
Schedule 1	Restricted. Use permit only.
Schedule 2	Restricted to certified agriculturalists, licenced exterminators, registered custom sprayers and permit holders.
Schedule 3	Agriculturists and consumer use.
Schedule 4	"Domestic" products only.
Schedule 5	Limited to application on agricultural land. Similar to Schedule 2.
Schedule 6	Similar to Schedule 4 but may be registered for agricultural/commercial use. Container size 1 litre or greater.

For more information on the regulatory aspects of the classification, please contact the Ministry of the Environment office nearest you. See Appendix D for a listing of MOE offices.

APPENDIX D. Ontario Ministry of the Environment Pesticide Control Offices

REGION County	PESTICIDES OFFICER Address	Telephone
Central Region Toronto, Halton, Peel York, Durham	**Charles Zubovits** 5775 Yonge St, 8th Floor Toronto, Ontario M2M 4J1	(416) 326-3671 Toll Free 1-800-810-8048 Fax (416) 325-6347
West-Central Region Haldimand-Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	**Paul McCubbin** Ontario Government Building 119 King St. West, 12th Floor Hamilton, Ontario L8P 4Y7	(905) 521-7667 Fax (905) 521-7820
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry , Haliburton, Peterborough, Victoria, Northumberland, Renfrew, Ottawa-Carleton, Lanark, District of Nipissing (Twsps of Airy, Murchison, Dickens, Lyell and Sabine)	**Andrew Morley** **Laurel Grills** 133 Dalton Avenue P.O. Box 820 Kingston, Ontario K7L 4X6	(613) 549-4000 Toll Free 1-800-267-0974 Fax (613) 548-6908
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth,Simcoe	**Doug Morrow** **Wray Lampman** 695 Exeter Road, 2nd Floor London, Ontario N6E 1L3	(519) 873-5041 (519) 873-5048 Fax (519) 873-5020
Northern Region Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma East, Cochrane East, Muskoka Kenora, Rainy River, Thunder Bay, Algoma West, Cochrane West, Timmins	**John Negusanti** 199 Larch Street, Ste 1101 Sudbury, Ontario P3E 5P9	(705) 564-3249 Fax (705) 564-4180
	Don Mitchell 435 James St. S., Suite 331 Thunder Bay, Ontario P7E 6S7	(807) 475-1712 Fax (807) 475-1745
Standards Development Branch	Pesticides Section 40 St. Clair Avenue West, 7th Floor Toronto, Ontario M4V 1M2	(416) 327-5519 Fax (416) 327-2936
Approvals Branch	Pesticides Licensing 2 St. Clair Avenue West, 12A Floor Toronto, Ontario M4V 1L5	(416) 314-8001 Fax (416) 314-8452

APPENDIX E. Diagnostic Service

Samples for disease diagnosis, insect or weed identification, nematodes counts and Verticillium testing can be sent to:

Pest Diagnostic Clinic
Laboratory Services Division
University of Guelph
95 Stone Rd. W.,
GUELPH, Ont., N1H 8J7
Telephone: (519) 767-6256 Fax: (519) 767-6240
E-mail: *pdc@lsd.uoguelph.ca*

Payment must accompany samples at the time of submission.

SUBMISSION FORMS ARE AVAILABLE AT:
www.uoguelph.ca/pdc

Charges will be applied to each sample submitted.
Payment: Please make cheque payable to the University of Guelph. VISA and Mastercard are also accepted. Please do not mail cash.

FEE SCHEDULE

Procedures	Price/Sample
Plant Diseases	
Diagnosis not requiring plating	$25
Diagnosis requiring plating	$40
Turf diagnosis	$50
Bacterial identification using Biolog®	$95
Detection of virus using Transmission Electron Microscopy	$85
Detection of virus using ELISA (turn around time = 5 working days, Bulk rates available)	$60
Weed Identification	$40
Insects	
Basic identification	$25
Identification requiring dissection and/or extensive keys	$40
Nematode and Verticillium Counts	**Price/Sample**
Nematodes extracted from soil (Bearman Pan Method)	$25
Soybean Cyst Nematode & Egg Count	$35
Nematodes extracted from roots	$60
Verticillium Count	$60
Turn Around Time	
Nematodes extracted from soil	7 or 8 days
Nematodes extracted from roots	15 days
Cyst count	3 or 4 days

How to Sample for Nematodes

Soil

When to Sample

Soil and root samples can be taken at any time of the year whenever the soil is not frozen. In Ontario nematode soil population levels are generally at their highest in May–June and again in September–October.

How to Sample Soil

Take samples with a soil sampling tube, trowel or narrow bladed shovel. Sample soil to a depth of 20–25 cm (8–10 in). If the soil is bare, remove the top 2 cm (1 in.) prior to sampling. A sample should consist of 10 or more subsamples combined. Mix well. Then take a sample of 1/2 L to 1 L (1 pint to 1 quart) from this. No one sample should represent more than 2.5 ha (6.25 ac.)

Mix subsamples in a clean pail or plastic bag.

Sampling Pattern

If living crop plants are present in the sample area, take samples within the row and from the area of the feeder root zone (with trees this is the drip line).

Number of Subsamples

Based on the total area sampled

500 m^2 (5,400 ft^2)	10 subsamples
500 m^2 – 0.5 ha (5,400 ft^2 – 1.25 ac.)	25 subsamples
0.5 ha – 2.5 ha (1.25 - 6.25 ac.)	50 subsamples

Roots

From small plants sample entire root system plus adhering soil. For large plants, 10–20 g (1/2–1 oz.) dig fresh weight from the feeder root zone and submit.

Problem Areas

Take soil and root samples from the margins of the problem area where the plants are still living. If possible, take both soil and root samples from problem and healthy areas in the same field.

Sample Handling

Soil Samples

Place in plastic bags as soon as possible after collecting.

Root Samples

Place in plastic bags and cover with moist soil from the sample area.

Storage

Store samples between 5°C and 10°C (40°F and 50°F) and do not expose to direct sunlight or extreme heat or cold (freezing). **Only living nematodes can be counted. Accurate counts depend on proper handling of samples.**

Submitting Plant for Disease Diagnosis or Identification

Sample Submission Forms

Obtain forms from your local OMAF office. Carefully fill in all of the categories on the form. In the space provided draw the most obvious symptom and the pattern of the disease in the field. It is important to include the cropping history of the area for the past 3 years and this year's pesticide use records.

Choose a complete, representative sample showing early symptoms. Submit as much of the plant as is practical, including the root system, or several plants showing a range of symptoms. For turfgrass, submit a 10–15 cm, square piece of turf, including thatch and at least 5 cm of soil. Take the sample from the outside edge of a ring or patch and include healthy and unhealthy turf and the interface between. If symptoms are general, collect the sample from an area where they are of intermediate severity. **Completely dead material is usually inadequate for diagnosis.** With plant specimens submitted for identification, include a 20–25 cm sample of the top portion of the stem with lateral buds, leaves, flowers or fruits in identifiable condition. Wrap plants in newspaper and put in a plastic bag. Tie the root system off in a separate plastic bag to avoid drying out and soil contaminating the leaves. **DO NOT** add moisture, as this encourages decay in transit. Cushion specimens and pack in a sturdy box to avoid damage during shipping. Avoid leaving specimens to bake or freeze in a vehicle or in a location where they could deteriorate.

Delivery

Deliver to the Pest Diagnostic Clinic as soon as possible by first class mail or by courier at the beginning of the week.

Submitting Insect Specimens for Identification

Collecting Samples

Place dead, hard bodied insects and spiders in vials or boxes and cushioned with tissues or cotton. Put soft bodied insects and caterpillars in vials containing alcohol. Do not use water as this will result in rot. Do not tape insect to paper or send them loose in an envelope.

Place live insects in a container with enough plant "food" to support them during transit. Be sure to write "live" on the outside of the container.

APPENDIX F. Other Contacts

AGRICULTURE & AGRI-FOOD CANADA RESEARCH CENTRES

Eastern Cereals and Oilseeds Research Centre
960 Carling Avenue
Ottawa, K1A 0C6
Tel (613) 759-1952
http://res2agr.ca/ecorc/welcome.htm

Greenhouse and Processing Crops Centre
Harrow N0R 1G0
Tel (519) 738-2251
http://res2.agr.ca/harrow/

Southern Crop Protection and Food Research Centre
http://res2.agr.ca/london/pmrc/pmrchome.html

1391 Sandford Street
London N5V 4T3
Tel (519) 457-1470

Vineland Research Farm
4902 Victoria Avenue North
Vineland L0R 2E0
Tel (905) 562-4113

Delhi Research Farm
Box 186 Schafer Road
Delhi N4B 2W9
Tel (519) 582-1950

CANADIAN FOOD INSPECTION AGENCY REGIONAL OFFICES (PLANT PROTECTION)

www.cifa-acia.agr.ca

Belleville
345 College Street East
Belleville, K8N 5S7
Tel (613) 969-3333

Brantford
Federal Building, Dalhousie & Queen St., P.O. Box 637
Brantford, N3T 5P9
Tel (519) 751-8157

Hamilton
709 Main Street West, Suite 101
Hamilton, L8S 1A2
Tel (905) 572-4152

London
457 Richmond Street, Suite 404
London, N6A 3E3
Tel (519) 645-4021

Niagara Falls
Mailing address: P.O. Box 35, Niagara Falls, L2E 6S8

Street address: 4551 Zimmerman Avenue
Niagara Falls, L2E 3M5
Tel (905) 357-5981

Ottawa District
3 Observatory Crescent
Building #3 Central, Experimental Farm
Ottawa, K1A 0C9
Tel (613) 759-1571

Toronto
401 Champagne Drive, Unit 1
Downsview, M3J 2C6
Tel (416) 954-1714

Windsor
441 University Avenue West, Suite 208
Windsor, N9A 5P9
Tel (519) 252-7095

UNIVERSITY OF GUELPH

Main Campus
Guelph, N1G 2W1
Tel (519) 824-4120
www.uoguelph.ca

Alfred College
Alfred, K0B 1A0
Tel (613) 679-2218
www.alfredc.uoguelph.ca

Kemptville College
Kemptville, K0G 1J0
Tel (613) 258-8336
www.kemptvillec.uoguelph.ca

Ridgetown College
Ridgetown, N0P 2C0
Tel (519) 674-1500
www.ridgetownc.on.ca

Department of Plant Agriculture

www.plant.uoguelph.ca

Department of Plant Agriculture, Kettleby
1125 Woodchopper's Lane, R.R. #1
Kettleby, L0G 1J0
Tel (905) 775-3783

Department of Plant Agriculture, Simcoe
Box 587 Blue Line Road
Simcoe, N3Y 4N5
Tel (519) 426-7127

Department of Plant Agriculture, Vineland
Box 7000, 4890 Victoria Avenue North
Vineland Station, L0R 2E0
Tel (905) 562-4141

Lab Services Division

www.uoguelph.ca/labserv/

Pesticide and Trace Contaminants
P.O. Box 3650, 95 Stone Road West
Guelph, N1H 8J7
Tel (519) 767-6200

Pest Diagnostic Clinic
Tel (519) 767-6256

APPENDIX G. The Metric System

Metric Units

Linear Measures (length)

10 millimetres (mm)	=	1 centimetre (cm)
100 centimetres (cm)	=	1 metre (m)
1,000 metres	=	1 kilometre (km)

Square Measures (area)

100 m X 100 m = 10,000 m^2	=	1 hectare (ha)
100 ha	=	1 square kilometre (km^2)

Cubic Measures (volume)

Dry Measure

1,000 cubic millimetres (mm^3)	=	1 cubic centimetre (cm^3)
1,000,000 cm^3	=	1 cubic metre (m^3)

Liquid Measure

1,000 millilitres (mL)	=	1 litre (L)
100 L	=	1 hectolitre (hL)

Weight-Volume Equivalents (for water)

(1.00 kg) 1,000 grams	=	1 litre (1.00 L)
(0.50 kg) 500 g	=	500 mL (0.50 L)
(0.10 kg) 100 g	=	100 mL (0.10 L)
(0.01 kg) 10 g	=	10 mL (0.01 L)
(0.001 kg) 1 g	=	1 mL (0.001 L)

Weight Measures

1,000 milligrams (mg)	=	1 gram (g)
1,000 g	=	1 kilogram (kg)
1,000 kg	=	1 tonne (t)
1 mg/kg	=	1 part per million (ppm)

Dry–Liquid Equivalents

1 cm^3	=	1 mL
1 m^3	=	1000 L

Application Rate Conversions

Metric to Imperial (Approximate)

litres per hectare x 0.09	=	gallons per acre
litres per hectare x 0.36	=	quarts per acre
litres per hectare x 0.71	=	pints per acre
millilitres per hectare x 0.015	=	fluid ounces per acre
grams per hectare x 0.015	=	ounces per acre
kilograms per hectare x 0.89	=	pounds per acre
tonnes per hectare x 0.45	=	tons per acre

Imperial to Metric (Approximate)

gallons per acre x 11.23	=	litres per hectare (L/ha)
quarts per acre x 2.8	=	litres per hectare (L/ha)
pints per acre x 1.4	=	litres per hectare (L/ha)
fluid ounces per acre x 70	=	millilitres per hectare (mL/ha)
tons per acre x 2.24	=	tonnes per hectare (t/ha)
pounds per acre x 1.12	=	kilograms per hectare (kg/ha)
ounces per acre x 70	=	grams per hectare (g/ha)

Liquid Equivalents

Litres/Hectare		*Approximate Gallons/Acre*
50	=	5
100	=	10
150	=	15
200	=	20
250	=	25
300	=	30

Dry Weight Equivalents

Grams or Kilograms / Hectare		*Ounces or Pounds /Acre*
100 grams	=	1 1/2 ounces
200 grams	=	3 ounces
300 grams	=	4 1/4 ounces
500 grams	=	7 ounces
700 grams	=	10 ounces
1.10 kilograms	=	1 pound
1.50 kilograms	=	1 1/4 pounds
2.00 kilograms	=	1 3/4 pounds
2.50 kilograms	=	2 1/4 pounds
3.25 kilograms	=	3 pounds
4.00 kilograms	=	3 1/2 pounds
5.00 kilograms	=	4 1/2 pounds
6.00 kilograms	=	5 1/4 pounds
7.50 kilograms	=	6 3/4 pounds
9.00 kilograms	=	8 pounds
11.00 kilograms	=	10 pounds
13.00 kilograms	=	11 1/2 pounds
15.0 kilograms	=	13 1/2 pounds

Metric Conversions

5 mL	=	1 tsp
15 mL	=	1 tbsp
28.5 mL	=	1 fl. oz

Conversion Tables — Metric to Imperial

Length		
1 millimetre (mm)	=	0.04 inch
1 centimetre (cm)	=	0.40 inch
1 metre (m)	=	39.40 inches
1 metre (m)	=	3.28 feet
1 metre (m)	=	1.09 yards
1 kilometre (km)	=	0.62 mile
Area		
1 square centimetre (cm^2)	=	0.16 square inch
1 square metre (m^2)	=	10.77 square feet
1 square metre (m^2)	=	1.20 square yards
1 square kilometre (km^2)	=	0.39 square mile
1 hectare (ha)	=	107,636 square feet
1 hectare (ha)	=	2.5 acres
Volume (dry)		
1 cubic centimetre (cm^3)	=	0.061 cubic inch
1 cubic metre (m^3)	=	1.31 cubic yards
1 cubic metre (m^3)	=	35.31 cubic feet
1,000 cubic metres (m^3)	=	0.81 acre-foot
1 hectolitre (hL)	=	2.8 bushels
Volume (liquid)		
1 millilitre (mL)	=	0.035 fluid ounce
1 litre (L)	=	1.76 pints
1 litre (L)	=	0.88 quart
1 litre (L)	=	0.22 gallon (Imp.)
1 litre (L)	=	0.26 gallon (U.S.)
Weight		
1 gram (g)	=	0.035 ounce
1 kilogram (kg)	=	2.21 pounds
1 tonne (t)	=	1.10 short tons
1 tonne (t)	=	2,205 pounds
Pressure		
1 kilopascal (kPa)	=	0.15 pounds/in^2
Speed		
1 metre per second	=	3.28 feet per second
1 metre per second	=	2.24 miles per hour
1 kilometre per hour	=	0.62 mile per hour
Temperature		
°F	=	(°C X 9/5) + 32

Conversion Tables — Imperial to Metric

Length		
1 inch	=	2.54 cm
1 foot	=	0.30 m
1 yard	=	0.91 m
1 mile	=	1.61 km
Area		
1 square foot	=	0.09 m^2
1 square yard	=	0.84 m^2
1 acre	=	0.40 ha
Volume (dry)		
1 cubic yard	=	0.76 m^3
1 bushel	=	36.37 L
Volume (liquid)		
1 fluid ounce (Imp.)	=	28.41 mL
1 pint (Imp.)	=	0.57 L
1 gallon (Imp.)	=	4.55 L
1 gallon (U.S.)	=	3.79 L
Weight		
1 ounce	=	28.35 g
1 pound	=	453.6 g
1 ton	=	0.91 tonne
Pressure		
1 pound per square inch	=	6.90 kPa
Temperature		
°C	=	(°F – 32) x 5/9

Abbreviations

%	= per cent (by weight)
ai	= active ingredient
AP	= agricultural powder
cm	= centimetre
cm^2	= square centimetre
DG	= dispersible granular
DP	= dispersible powder
E	= emulsifiable
e.g.	= for example
EC	= emulsifiable concentrate
F	= flowable
g	= gram
Gr	= granules, granular
ha	= hectare
kg	= kilogram
km/h	= kilometres per hour
kPa	= kilopascal
L	= litre
m	= metre
m/s	= metres per second
m^2	= square metre
mL	= millilitre
mm	= millimetre
SC	= sprayable concentrate
SP	= soluble powder
t	= tonne
W	= wettable (powder)
WDG	= water dispersible granular
WP	= wettable powder
km/h	= kilometres per hour

APPENDIX H. Field Record Form 20__

	Field I.D.				Field I.D.				Field I.D.				Field I.D.			
Acreage																
Soil Type																
Soil Fertility	pH	N	P	K	pH	N	P	K	pH	N	P	K	pH	N	P	K
Tillage																
Variety/Hybrid																
Seeding Rate																
Seeding Date																
Seed Treatment																
Fertilizer/Lime product, rate, timing																
Manure Application																
Herbicides																
Fiate																
Crop Stage																
Date																
Yield																
Harvest Date																
Moisture																
Test Wt/Grade																
Notes																

APPENDIX I. Field Scouting Report

Farm: Scout: Date: Time:

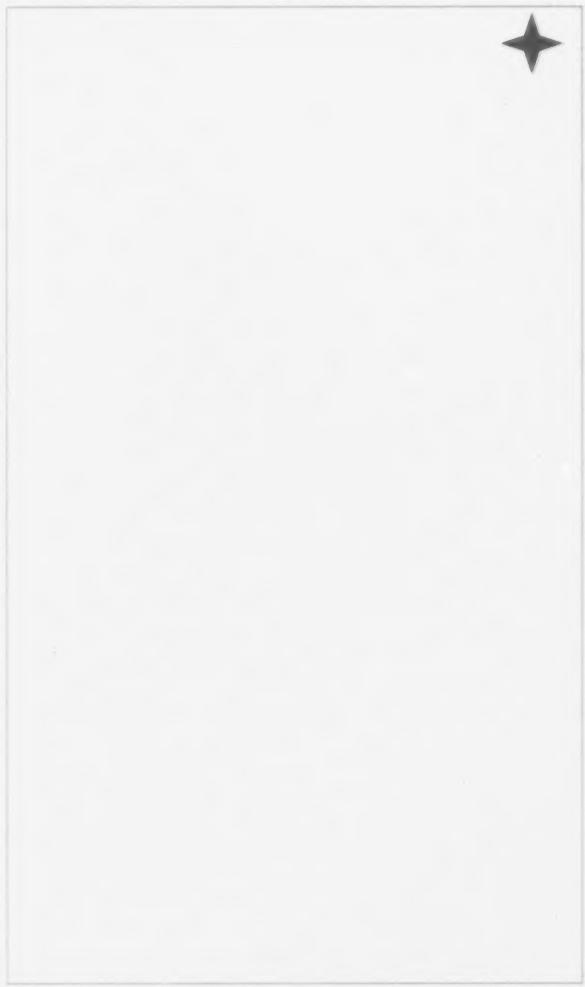
Field: Acreage: Crop: Plant Population:

Crop Growth Stage, Height and Condition:

Soil Condition:

Weeds	Growth Stage	Pressure/Density
Insects	**Stage**	**Pressure/Density**
Diseases	**Stage**	**Pressure**

Field Map: weed, insect, disease patches, crop condition, including GSP coordinates



Field Scout's Comments:

Action Recommended:

Emergency and First-Aid Procedures for Pesticide Poisoning

For a major spill, a theft or a fire involving a pesticide call the Ministry of the Environment at **1-800-268-6060.**

For pesticide poisonings and pesticide injuries call the Poison Information Centre:

Toronto	1-800-268-9017
Ottawa (Bilingual)	1-800-267-1373
Hearing Assistance (TTY)	1-877-750-2233

PREVENT ACCIDENTS

- **Read the label**. Follow all the precautions the label recommends. Read the First Aid section of the label BEFORE you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Material Safety Data Sheets (MSDS) for the pesticides you use**. Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.

If someone has been working with pesticides and you see any possible symptoms of pesticide poisoning or injury, take emergency action immediately.

IF AN ACCIDENT OR POISONING HAPPENS

- Protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the 4 basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.
- Call an ambulance or the Poison Information Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, MSDS sheet or container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

FIRST AID

If a pesticide comes in contact with skin:

- remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water
- dry skin well and cover with clean clothing or other clean material.

If pesticide comes in contact with eyes:

- hold eyelids open wash the eyes with clean running water for 15 minutes or more.

If pesticide was inhaled:

- move the victim to fresh air and loosen tight clothing
- give artificial respiration if the victim is not breathing.

Do not breathe in the exhaled air from the victim — you could also be poisoned.

If a pesticide was swallowed:

- **call the Poison Information Centre IMMEDIATELY.**

Emergency numbers are listed at the front of each Bell telephone directory.

For information, or to obtain copies of this or any other ministry publication please: call 1-888-466-2372 from within Ontario, (519) 826-3700 from outside the province or OMAF's TTY line at (519) 826-7402 for the hearing impaired, email your request to *products@omaf.gov.on.ca*, or visit OMAF's Web site at *www.gov.on.ca/omaf*.

A complete list of all OMAF products and services, and order forms, are available on the Web site. Orders can be faxed to (519) 826-3633 or mailed to Government Information Centre, OMAF, 1 Stone Road West, Guelph, Ontario N1G 4Y2.

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